Club Car



DS GOLF CARS
GASOLINE/ELECTRIC

MANUAL NUMBER 102067501 EDITION CODE 0300C0312B

FOREWORD

Club Car golf cars are designed and built to provide maximum efficiency and performance. However, proper maintenance and repair is essential for achieving maximum service life and continued safe and reliable operation. This maintenance and service manual provides detailed procedures for the maintenance and repair of those components that are common to all Club Car DS Golf Cars, and should be used in conjunction with the appropriate maintenance and service supplement. The supplement will provide maintenance and repair procedures for those components specific to a particular type of vehicle. If you do not have the appropriate supplement for your vehicle(s), you may obtain one of the following from your Club Car dealer/distributor:

2000 PowerDrive System 48 Vehicle Maintenance & Service Supplement Publication Part No. 102067505 2000 PowerDrive Plus Vehicle Maintenance & Service Supplement Publication Part No. 102067506 2000 V-Glide 36-Volt Vehicle Maintenance & Service Supplement Publication Part No. 102067504 2000 FE 290 Gasoline Vehicle Maintenance & Service Supplement Publication Part No. 102067508

This manual and the supplement should be read prior to servicing the vehicle. The procedures provided must be properly implemented, and the DANGER, WARNING, and CAUTION statements must be heeded.

This manual was written for the vehicle technician who already possesses knowledge and skills in electrical and mechanical repair. If the technician does not have such knowledge and skills, attempted service or repairs to the vehicle may render it unsafe. For this reason, we advise that all repairs and/or service be performed by an authorized Club Car distributor's/dealer's representative or by a Club Car factory trained technician.

It is the policy of Club Car, Inc. to assist its distributors and dealers in continually updating their service knowledge and facilities so they can provide prompt and efficient service for vehicle owners. Regional technical representatives, golf car service seminars, periodic service bulletins, maintenance and service manuals, and other service publications also represent Club Car's continuing commitment to customer support.

This service manual, used in conjunction with the appropriate supplement, covers all aspects of typical DS Golf Car service. However, unique situations do sometimes arise when servicing a golf car. If it appears that a service question is not answered in this manual or the supplement, you may write to us at: Club Car, Inc.; P.O. Box 204658; Augusta, GA 30917; Attention: Technical Services, or contact a Club Car Technical Service representative at (706) 863-3000, extension 3580.

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A WARNING

- READ SECTION 1-SAFETY BEFORE ATTEMPTING ANY SERVICE ON THIS VEHICLE.
- BEFORE SERVICING VEHICLE, READ COMPLETE SECTION(S) AND ANY REFERENCED INFORMATION RELEVANT TO SERVICE OR REPAIR TO BE PERFORMED.

NOTE

- THIS MANUAL REPRESENTS THE MOST CURRENT INFORMATION AT TIME OF PUBLICATION. CLUB CAR, INC. IS CONTINUALLY WORKING TO FURTHER IMPROVE OUR VEHICLES AND OTHER PRODUCTS. THESE IMPROVEMENTS MAY AFFECT SERVICING PROCEDURES. ANY MODIFICATION AND/OR SIGNIFICANT CHANGE IN SPECIFICATIONS OR PROCEDURES WILL BE FORWARDED TO ALL CLUB CAR DISTRIBUTORS AND DEALERS AND WILL, WHEN APPLICABLE, APPEAR IN FUTURE EDITIONS OF THIS MANUAL.
- DAMAGE TO A VEHICLE OR COMPONENT THEREOF NOT RESULTING FROM A DEFECT OR WHICH OCCURS DUE TO UNREASONABLE OR UNINTENDED USE, OVERLOADING, ABUSE, OR NEGLECT (INCLUDING FAILURE TO PROVIDE REASONABLE OR NECESSARY MAINTENANCE AS INSTRUCTED IN THE VEHICLE OWNER'S MANUAL), ACCIDENT OR ALTERATION, INCLUDING INCREASING VEHICLE SPEED BEYOND FACTORY SPECIFICATIONS OR MODIFICATIONS WHICH AFFECT THE STABILITY OF THE VEHICLE OR THE OPERATION THEREOF, WILL VOID THE WARRANTY.
- CLUB CAR, INC. RESERVES THE RIGHT TO CHANGE SPECIFICATIONS AND DESIGNS AT ANY TIME WITHOUT NOTICE AND WITHOUT INCURRING ANY OBLIGATION OR LIABILITY WHATSOEVER.
- THERE ARE NO WARRANTIES EXPRESSED OR IMPLIED IN THIS MANUAL. SEE THE LIMITED WARRANTY FOUND IN THE VEHICLE OWNER'S MANUAL OR WRITE TO CLUB CAR, INC.

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SECTION 1-SAFETY

To insure the safety of those servicing Club Car DS Golf Cars, and to protect the vehicles from possible damage resulting from improper service or maintenance, the procedures in this manual must be followed. It is important to note that throughout this manual there are statements which are contained within boxes labeled **DANGER**, **WARNING**, or **CAUTION**. These special statements relate to specific safety issues, and must be read, understood, and heeded before proceeding with procedures. There are also boxes labeled **NOTE**, which provide other essential service or maintenance information.

A DANGER

• A DANGER INDICATES AN IMMEDIATE HAZARD WHICH WILL RESULT IN SEVERE PERSONAL INJURY OR DEATH.

WARNING

• A WARNING INDICATES AN IMMEDIATE HAZARD WHICH COULD RESULT IN SEVERE PERSONAL INJURY OR DEATH.

A CAUTION

• A CAUTION INDICATES HAZARDS OR UNSAFE PRACTICES WHICH MAY RESULT IN PRODUCT OR PROPERTY DAMAGE OR MINOR PERSONAL INJURY.

NOTE

• A NOTE PROVIDES KEY INFORMATION TO MAKE PROCEDURES MORE EASILY UNDERSTOOD.

GENERAL WARNING

The following safety procedures must be followed whenever the vehicle is being operated, repaired, or serviced. Service technicians should become familiar with these general statements, which will be found frequently throughout this manual. Also, other specific warnings appear throughout this manual and on the vehicle.

A DANGER

- BATTERY EXPLOSIVE GASES! DO NOT SMOKE. KEEP SPARKS AND FLAMES AWAY FROM THE VEHICLE. VENTILATE WHEN CHARGING OR USING IN AN ENCLOSED SPACE. ALWAYS WEAR A FULL FACE-SHIELD AND RUBBER GLOVES WHEN WORKING ON OR NEAR BATTERIES.
- BATTERY POISON! CONTAINS ACID! CAUSES SEVERE BURNS. AVOID CONTACT WITH SKIN, EYES, OR CLOTHING. ANTIDOTES:
 - EXTERNAL: FLUSH WITH WATER. CALL A PHYSICIAN IMMEDIATELY.
 - INTERNAL: DRINK LARGE QUANTITIES OF WATER. FOLLOW WITH MILK OF MAGNESIA OR VEGETABLE OIL. CALL A PHYSICIAN IMMEDIATELY.
 - EYES: FLUSH WITH WATER FOR FIFTEEN MINUTES. CALL A PHYSICIAN IMMEDIATELY.

SAFETY General Warning

General Warning, Continued:

A DANGER

• GASOLINE - FLAMMABLE! EXPLOSIVE! DO NOT SMOKE. KEEP SPARKS AND FLAMES AWAY FROM VEHICLE AND SERVICE AREA. SERVICE ONLY IN A WELL-VENTILATED AREA.

- DO NOT OPERATE GASOLINE VEHICLE IN AN ENCLOSED AREA WITHOUT PROPER VENTILATION. THE ENGINE PRODUCES CARBON MONOXIDE WHICH IS AN ODORLESS, DEADLY POISON.
- A GOLF CAR WILL NOT PROVIDE PROTECTION FROM LIGHTNING, FLYING OBJECTS, OR OTHER STORM RELATED HAZARDS. IF CAUGHT IN A STORM WHILE DRIVING A GOLF CAR, EXIT THE VEHICLE AND SEEK SHELTER IN ACCORDANCE WITH APPLICABLE SAFETY GUIDELINES FOR YOUR LOCATION.

A WARNING

- ONLY TRAINED TECHNICIANS SHOULD REPAIR OR SERVICE THE VEHICLE. ANYONE DOING EVEN SIMPLE REPAIRS OR SERVICE SHOULD HAVE KNOWLEDGE AND EXPERIENCE IN ELECTRICAL AND MECHANICAL REPAIR.
- FOLLOW THE PROCEDURES EXACTLY AS STATED IN THIS MANUAL, AND HEED DANGER, WARNING, AND CAUTION STATEMENTS LISTED IN THIS MANUAL AS WELL AS THOSE AFFIXED TO THE VEHICLE.
- IMPROPER USE OF THE VEHICLE OR FAILURE TO PROPERLY MAINTAIN IT, COULD RESULT IN DECREASED VEHICLE PERFORMANCE OR SEVERE PERSONAL INJURY.
- ANY MODIFICATION OR CHANGE TO THE VEHICLE WHICH AFFECTS THE STABILITY OR HANDLING OF THE VEHICLE, OR INCREASES MAXIMUM VEHICLE SPEED BEYOND FACTORY SPECIFICATIONS, COULD RESULT IN SEVERE PERSONAL INJURY OR DEATH.
- CHECK THE VEHICLE OWNER'S MANUAL FOR PROPER LOCATION OF ALL VEHICLE WARNING DECALS AND MAKE SURE THAT THEY ARE IN PLACE AND ARE EASY TO READ.
- WEAR SAFETY GLASSES OR APPROVED EYE PROTECTION WHEN SERVICING THE VEHICLE.
- DO NOT WEAR LOOSE CLOTHING. REMOVE JEWELRY SUCH AS RINGS, WATCHES, CHAINS, ETC. BEFORE SERVICING VEHICLE.
- MOVING PARTS! DO NOT ATTEMPT TO SERVICE THE VEHICLE WHILE IT IS RUNNING.
- HOT! DO NOT ATTEMPT TO SERVICE HOT MOTOR, RESISTORS, ENGINE, OR EXHAUST SYSTEMS. FAILURE TO HEED THIS WARNING COULD RESULT IN SEVERE BURNS.
- USE INSULATED TOOLS WHEN WORKING AROUND BATTERIES OR ELECTRICAL CONNECTIONS. USE EXTREME CAUTION TO AVOID SHORTING OF COMPONENTS OR WIRING.
- LIFT ONLY ONE END OF VEHICLE AT A TIME. BEFORE LIFTING, LOCK THE BRAKES AND CHOCK THE WHEELS THAT REMAIN ON THE FLOOR. USE A SUITABLE LIFTING DEVICE (CHAIN HOIST OR HYDRAULIC FLOOR JACK) WITH 1000 LB. (454 KG.) MINIMUM LIFTING CAPACITY. DO NOT USE LIFTING DEVICE TO HOLD VEHICLE IN RAISED POSITION. ALWAYS USE APPROVED JACKSTANDS OF PROPER WEIGHT CAPACITY TO SUPPORT VEHICLE.
- TURN THE KEY SWITCH TO OFF, REMOVE THE KEY, CHOCK THE WHEELS, PLACE THE FORWARD AND REVERSE SWITCH IN NEUTRAL, AND DISCONNECT BATTERY(IES) PRIOR TO SERVICING THE VEHICLE.

WARNING CONTINUED ON NEXT PAGE . . .

A WARNING

GASOLINE VEHICLES ONLY:

- TO AVOID UNINTENTIONALLY STARTING THE VEHICLE:
 - DISCONNECT BATTERY CABLES, NEGATIVE (-) FIRST (FIGURE 1-1).
 - DISCONNECT THE SPARK PLUG WIRE FROM THE SPARK PLUG.
- FRAME GROUND DO NOT ALLOW TOOLS OR OTHER METAL OBJECTS TO CONTACT FRAME WHEN DISCONNECTING BATTERY CABLES OR OTHER ELECTRIC WIRING. NEVER ALLOW A POSITIVE WIRE TO TOUCH VEHICLE FRAME, ENGINE, OR METAL COMPONENT.

ELECTRIC VEHICLES ONLY:

- TO AVOID UNINTENTIONALLY STARTING THE VEHICLE, DISCONNECT BATTERIES AS SHOWN (FIGURES 1-2 OR 1-3).
- ON POWERDRIVE PLUS VEHICLES, PLACE TOW SWITCH IN THE TOW POSITION BEFORE DISCONNECTING BATTERIES.
- ON POWERDRIVE SYSTEM 48 VEHICLES, DISCHARGE THE CONTROLLER AS FOLLOWS **AFTER DISCONNECTING BATTERIES:**
 - TURN THE KEY SWITCH TO ON AND PLACE THE FORWARD/REVERSE HANDLE IN THE **REVERSE POSITION.**
 - SLOWLY DEPRESS THE ACCELERATOR PEDAL AND KEEP IT DEPRESSED UNTIL THE REVERSE WARNING BUZZER CAN NO LONGER BE HEARD. WHEN THE BUZZER STOPS SOUNDING, THE CONTROLLER IS DISCHARGED.

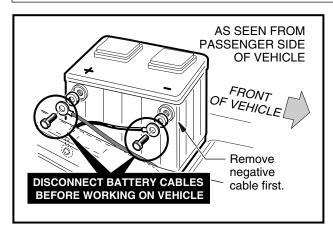


Figure 1-1 Gasoline Vehicle

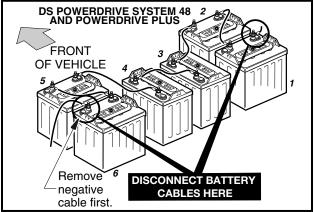


Figure 1-2 PowerDrive Vehicle

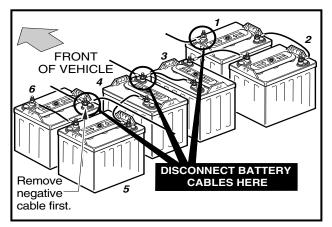


Figure 1-3 V-Glide 36-Volt Vehicle

SECTION 2-VEHICLE SPECIFICATIONS

GENERAL INFORMATION

Club Car, Inc. reserves the right to change vehicle specifications and design of either gasoline or electric vehicles at any time without obligation to make these changes on units previously sold.

SPECIFICATIONS	DS GASOLINE	POWERDRIVE SYSTEM 48 ELECTRIC	POWERDRIVE PLUS ELECTRIC	DS 36-VOLT ELECTRIC
POWER SOURCE				
Engine: 4 cycle, OHV, 286 cc, 9.0 hp rated, single cylinder, air cooled, with pressure lubrication system.	•			
Drive Motor: Direct drive, 48 volts DC, series wound, 3.1 hp.		•		
Drive Motor: Direct drive, 48 volts DC, shunt wound, 3.2 hp.			•	
Drive Motor: Direct drive, 36 volts DC, series wound, 2.97 hp.				•
Fuel System: Side draft carburetor with float bowl, fixed jets, fuel filter, and impulse fuel pump.	•			
Governor: Automatic ground speed sensing, internally geared in unitized transaxle.	•			
Ignition: Transistor electronic ignition with electronic RPM limiter.	•			
Unitized Transaxle: Fully synchronized forward and reverse with neutral and reduced speed reverse (11.8:1 forward, 17.1:1 reverse).	•			
Transaxle: Double reduction helical gear with 12.28:1 direct drive axle.		•	•	•
Electrical System: Battery - 12 volt, 500 cold cranking amps at 0°, 650 cranking amps at 32°, 105 minute reserve and 35 amp charging capacity.	•			
Electrical System: 48 volts DC, reduced speed reverse.		•	•	
Electrical System: 36 volts DC, reduced speed reverse.				•
Batteries: High capacity, deep cycle, Trojan PowerDrive 8 volt, 117 min. capacity.		•	•	
Batteries: High capacity, deep cycle, Trojan 6 volt, 115 min. capacity.				•
Charger: Automatic, 17 amp PowerDrive; UL and CSA listed.		•	•	
Charger: Automatic, 21 amp Accu-Power; UL and CSA listed.				•
Torque Converter: Automatic, variable speed, dry type.	•			
STEERING/SUSPENSION/BRAKES				
Steering: Self-adjusting rack and pinion.	•	•	•	•
Suspension: Front and rear tapered mono-leaf springs with dual hydraulic shocks.	•	•	•	•
Brakes: Dual rear wheel self-adjusting brakes with cast iron drums and single brake pedal with automatic-release park brake.	•	•	•	•
BODY/CHASSIS		_		
Frame/Chassis: Twin I-Beam welded aluminum.	•	•	•	•
Front and Rear Body: ArmorFlex®	•	•	•	•
Body Finish: Matched paint finish over molded-in color.	•	•	•	•
Tires: 18 x 8.5 - 8 tubeless, 4 ply rated.	•	•	•	•
SEATING CAPACITY/FUEL CAPACITY				
Standard Seating Capacity: 2 persons	•	•	•	•
Fuel Tank: 7 gallons (26.5 liters), unleaded gasoline only.	•			
SPECIFICATIONS CONTINUED ON NEXT PAGE				

VEHICLE SPECIFICATIONS General Information

SPECIFICATIONS	DS GASOLINE	POWERDRIVE SYSTEM 48 ELECTRIC	POWERDRIVE PLUS ELECTRIC	DS 36-VOLT ELECTRIC	
DIMENSIONS/WEIGHT					
Overall Length	91-1/2"	91-1/2"	91-1/2"	91-1/2"	
	(232 cm)	(232 cm)	(232 cm)	(232 cm)	
Overall Width	47-1/4"	47-1/4"	47-1/4"	47-1/4"	
	(120 cm)	(120 cm)	(120 cm)	(120 cm)	
Overall Height: At Steering Wheel.	48"	48"	48"	48"	
	(122 cm)	(122 cm)	(122 cm)	(122 cm)	
Wheelbase	65-1/2"	65-1/2"	65-1/2"	65-1/2"	
	(166 cm)	(166 cm)	(166 cm)	(166 cm)	
Ground Clearance	4-1/2"	4-1/2"	4-1/2"	4-1/2"	
	(11 cm)	(11 cm)	(11 cm)	(11 cm)	
Front Wheel Tread	34-1/2"	34-1/2"	34-1/2"	34-1/2"	
	(88 cm)	(88 cm)	(88 cm	(88 cm	
Rear Wheel Tread	38-1/2"	38-1/2"	38-1/2"	38-1/2"	
	(98 cm)	(98 cm)	(98 cm)	(98 cm)	
Weight: Standard electric vehicle (without batteries)		455 lb. (206 kg)	477 lb. (216 kg)	448 lb. (203 kg)	
Weight: Standard gasoline vehicle (dry, without battery)	598 lb. (271 kg)				
Forward Speed: At 2700 rpm	12-15 mph	12-15 mph	12-15 mph	12-15 mph	
	(19-24 kph)	(19-24 kph)	(19-24 kph)	(19-24 kph)	
Curb Clearance Circle (diameter)	17'-6"	17'-6"	17'-6"	17'-6"	
	(533 cm)	(533 cm)	(533 cm)	(533 cm)	
Braking Distance: At 12 mph (19 kph)	14'	14'	14'	14'	
	(427 cm)	(427 cm)	(427 cm)	(427 cm)	

VEHICLE CAPACITIES	Gasoline	Electric		
TIRE CAPACITIES				
Tire Pressure	12 -14 psi (83-96 kPa)	18-20 psi (124-138 kPa)		
LIQUID CAPACITIES				
Engine Crankcase without filter	32 oz. (.98 liters)			
Engine Crankcase with filter	38 oz. (1.16 liters)			
Unitized Transaxle	27 oz. (.8 liters)			
Gasoline Tank	7 gallons (26.5 liters)			
Transaxle		22 oz. (.67 liters)		

SECTION 3-GENERAL INFORMATION

There are four DS Golf Car models: the DS gasoline vehicle, the DS V-Glide 36-volt electric vehicle, the DS PowerDrive System 48 (48-volt) electric vehicle, and the DS PowerDrive Plus (48-volt) electric vehicle. Throughout this section, important features unique to each model are highlighted. We urge the owner/operator to read and understand this section, and to pay special attention to the features specific to his/her vehicle(s).

MODEL IDENTIFICATION

The serial number of your Club Car vehicle is printed on a bar code decal mounted on the frame directly above the accelerator pedal (Example: A0001-123456 for Electric or AG0001-123456 for Gasoline). **See Figure 3-1**, **Page 3-1**. There is also a second serial number decal mounted on the front body frame behind the center dash panel. The center dash panel must be removed to access this decal **(Figure 3-2, Page 3-1)**.

NOTE

• ALWAYS HAVE THE VEHICLE SERIAL NUMBER AT HAND WHEN ORDERING PARTS OR MAKING INQUIRIES.

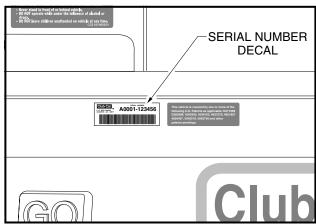


Figure 3-1 Serial Number Decal

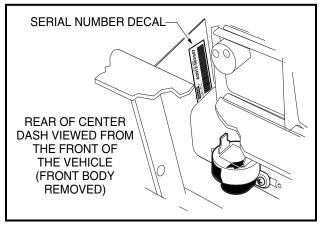


Figure 3-2 Serial Number Decal Behind Dash

SAFETY COMMITTEE

If the golf car is to be rented or is part of a fleet, we strongly recommend that a safety committee be appointed. One of the main concerns of this committee should be the safe operation of the golf cars.

This should include at a minimum:

- Where golf cars should be driven.
- Ensuring that proper warnings of driving hazards are displayed and visible.
- Who should and who should not drive golf cars.
- · Instructing first time drivers.
- Maintaining golf cars in a safe driving condition.
- How various rules are to be enforced.

The safety committee should include all these items and such others as the committee feels necessary or appropriate.

GENERAL INFORMATION Pre-Operation Checklist

PRE-OPERATION CHECKLIST

Your Club Car vehicle has been thoroughly inspected and adjusted at the factory and by your Club Car distributor/dealer. However, upon receipt of your new Club Car vehicle, you should become familiar with the controls and vehicle operation. Carefully inspect your vehicle to be satisfied it is in proper working condition before accepting delivery.

Use the following checklist as a guide to inspect your new vehicle. This checklist should also be used in conjunction with the Daily Pre-operation Safety Checklist. See Section 10–Periodic Maintenance, in the appropriate Maintenance and Service Supplement. Any problems should be corrected by a Club Car distributor/dealer or a Club Car factory trained technician.

- General: All parts should be in place and properly installed. Be sure that all nuts, bolts, and screws
 are tight. On the DS Gasoline vehicle, check all hose clamps for tight fit as well as starter belt for
 tightness.
- Warning Decals: Check to ensure that all warning and operation decals are in place. See the Vehicle Identification Pages at the beginning of the Vehicle Owner's Manual.
- Tires: Check for proper tire pressure. See Section 2-Specifications.
- Batteries (electric vehicles): Check electrolyte to ensure that it is at its proper level. See Section 13— Batteries, in the appropriate Maintenance and Service Supplement. Check battery posts. Wires should be tight and free of corrosion. Charge batteries fully before first use of vehicle.
- Multi-Step Potentiometer (48-volt electric vehicles) and V-Glide Wiper Switch (36-volt electric vehicles): Be sure accelerator switch cover is properly secured prior to operating the vehicle.
- Engine (gasoline vehicles): Check for proper engine oil level. See Engine Oil, Section 10-Periodic Maintenance, in the appropriate Maintenance and Service Supplement.
- Fuel (gasoline vehicles): Check fuel level. See Fueling Instructions, Section 10-Periodic Maintenance, in the appropriate Maintenance and Service Supplement.

A WARNING

• BE SURE THE PLASTIC HAS BEEN REMOVED FROM THE SEAT BOTTOM BEFORE OPERATING THE VEHICLE. FAILURE TO DO SO MAY RESULT IN A FIRE, PROPERTY DAMAGE, PERSONAL INJURY, OR DEATH.

PERFORMANCE INSPECTION

After you have familiarized yourself with the vehicle's controls and have read and understood the driving instructions, take the vehicle for a test drive. Use the following checklist as a guide to inspect the new vehicle. Any problems should be corrected only by your Club Car distributor/dealer or a Club Car factory trained technician.

All vehicles:

- **Brakes:** Be sure the brakes function properly. When brake pedal is fully depressed under moderate pressure, it should *not* go more than halfway to the floor, and vehicle should come to a smooth, straight stop within 14 feet. If the pedal goes more than halfway to the floor, or if the vehicle swerves or fails to stop within 14 feet, have the brake system checked and adjusted as required. Brake adjustment must be maintained so that the brake pedal *cannot* be depressed to the floor under any circumstance.
- Park Brake: When latched, the park brake should lock the wheels and hold the vehicle stationary (on incline of 20% or less). It should release when either the accelerator or brake pedal is depressed.

- Reverse Buzzer: The reverse buzzer should sound as a warning when the vehicle is in reverse.
- Steering: The vehicle should be easy to steer and should not have any play in the steering wheel.
- Accelerator: With the key switch ON and the Forward/Reverse handle in the FORWARD position; as the accelerator pedal is depressed, the engine or motor should start and the vehicle should come up smoothly to full speed. When pedal is released it should return to the original position and the engine or motor should stop. All DS (gasoline and electric) vehicles run at reduced speed in REVERSE.
- Governor (gasoline vehicles): Check maximum speed of the vehicle. The vehicle should run at 12-15 mph (19-24 kph) on a level surface.
- General: Listen for any unusual noises such as squeaks or rattles. Check the vehicle ride and performance. Have a Club Car distributor/dealer or a Club Car factory trained technician investigate anything unusual.

DS PowerDrive Plus Vehicles:

- Zero Speed Detect: With the vehicle parked on level ground and the park brake disengaged, place the tow switch in the RUN position and attempt to push the vehicle. It should resist rolling (moving at no more than 1 or 2 mph) with the Forward/Reverse switch in any position.
- "Pedal Up" Motor Braking: Accelerate the vehicle to full speed and then release the accelerator pedal. Motor braking should quickly and smoothly slow the vehicle to approximately 9 mph. Motor braking will disengage when vehicle slows to 9 mph.
- "Pedal Down" Motor Braking: Accelerate down an incline with the accelerator pedal depressed. When the vehicle reaches approximately 15 mph, motor braking should engage and moderate vehicle speed between 15 and 16 mph, depending upon the grade of the hill.

CONTROLS AND INDICATORS

A DANGER

 DO NOT OPERATE GASOLINE VEHICLE IN AN ENCLOSED AREA WITHOUT PROPER VENTILATION. GASOLINE ENGINES PRODUCE CARBON MONOXIDE GAS, WHICH IS AN **ODORLESS, DEADLY POISON.**

A WARNING

- IF RENTING OR LOANING THE VEHICLE, MAKE SURE DRIVER IS FAMILIAR WITH ALL CONTROLS AND OPERATING PROCEDURES BEFORE ALLOWING THE VEHICLE TO BE DRIVEN.
- DO NOT TAMPER WITH THE GASOLINE VEHICLE GOVERNOR. DOING SO WILL VOID THE WARRANTY, AS WELL AS DAMAGE THE ENGINE AND OTHER COMPONENTS, AND COULD RESULT IN PROPERTY DAMAGE, PERSONAL INJURY, OR DEATH DUE TO ACCIDENT AT UNSAFE SPEED.
- DO NOT MODIFY OR CHANGE THE VEHICLE IN ANY WAY WHICH MIGHT AFFECT ITS STABILITY OR HANDLING, OR INCREASE MAXIMUM SPEED BEYOND FACTORY SPECIFICATIONS. PROPERTY DAMAGE, PERSONAL INJURY, OR DEATH COULD RESULT.
- DO NOT SHIFT THE FORWARD/REVERSE HANDLE WHILE THE VEHICLE IS MOVING. TO AVOID INJURY TO AN UNSUSPECTING PASSENGER OR DAMAGE TO THE VEHICLE. ALWAYS BRING THE VEHICLE TO A FULL STOP BEFORE SHIFTING THE FORWARD/REVERSE HANDLE.

WARNING CONTINUED ON NEXT PAGE...

GENERAL INFORMATION Controls and Indicators

WARNING

 RELEASE THE ACCELERATOR PEDAL AND THEN DEPRESS THE BRAKE PEDAL FIRMLY UNTIL THE VEHICLE STOPS. TO AVOID UNINTENTIONALLY STARTING OR ROLLING THE VEHICLE, SET THE PARK BRAKE, TURN THE KEY SWITCH TO OFF, AND REMOVE THE KEY WHEN LEAVING THE VEHICLE.

KEY SWITCH

The key switch is mounted on the dash to the right of the steering column (Figure 3-3, Page 3-4). It has two positions, OFF and ON, which are clearly labeled.

NOTE

THE KEY CAN BE REMOVED WHEN THE KEY SWITCH IS IN THE OFF POSITION ONLY.

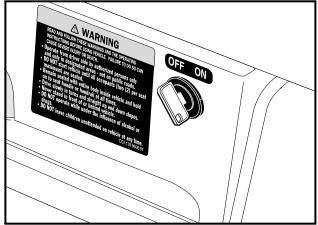
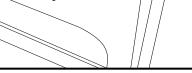


Figure 3-3 Key Switch



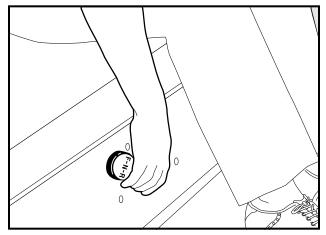


Figure 3-4 Forward and Reverse Handle

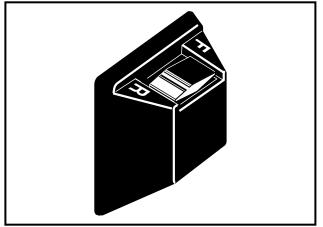
FORWARD/REVERSE CONTROL

DS Gasoline, DS V-Glide Electric, and DS PowerDrive System 48

The Forward/Reverse shift handle is located on the seat support panel, below and to the right of the driver's right knee (Figure 3-4, Page 3-4). The handle has three distinct positions: F (FORWARD), N (NEUTRAL), and R (REVERSE). Rotate the handle towards the driver, F (FORWARD), to run the vehicle in the forward direction, or towards the passenger, **R** (REVERSE), to run the vehicle in reverse. When the handle is in the straight up, or N (NEUTRAL) position, the vehicle will not run. The engine on the DS gasoline vehicle will stop if it is shifted to this position while running. DS electric and gasoline vehicles operate at reduced speed in reverse. The reverse buzzer will sound as a warning when the forward/reverse handle is in REVERSE.

DS PowerDrive Plus

The Forward/Reverse rocker switch is located on the seat support panel below and to the right of the driver's right knee. The \mathbf{F} (FORWARD) and \mathbf{R} (REVERSE) positions are clearly marked on the switch. Push down the F (FORWARD) side of the switch to run the vehicle in the forward direction, or push down the R (REVERSE) side of the switch to run the vehicle in reverse. When the switch is positioned with neither side down, the vehicle is in the neutral position and the vehicle will not run if the accelerator pedal is depressed (Figure 3-5, Page 3-5). The reverse buzzer will sound as a warning when the forward/reverse switch is in REVERSE.



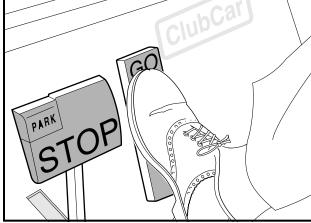
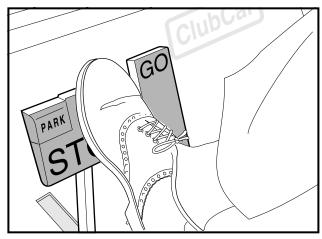


Figure 3-5 PowerDrive Plus Forward/Reverse Switch

Figure 3-6 Accelerator and Brake Pedals





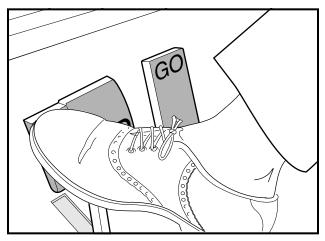


Figure 3-8 Depress Park Brake Pedal

ACCELERATOR PEDAL

The accelerator pedal is the pedal on the right, with the word GO molded into it (Figure 3-6, Page 3-5).

The operation of the accelerator pedal differs from that of an automobile. When the key switch is ON, and the forward/reverse handle is in either FORWARD or REVERSE, depressing the accelerator pedal will automatically release the park brake and start the vehicle moving in the direction selected (forward or reverse). As the accelerator pedal is depressed, speed will increase until full speed is reached. When the accelerator is released, power will be cut off and the engine or motor will stop running.

• Powerdrive Plus Vehicles Only: See "pedal-up" and "pedal-down" motor braking on Page 3-3.

BRAKE PEDAL

The brake pedal is the large pedal on the left with the word **STOP** molded into it (Figure 3-7, Page 3-5). To slow or stop the vehicle, depress the brake pedal with your right foot (Figure 3-8, Page 3-5).

PARK BRAKE PEDAL

The park brake pedal is the small raised portion in the upper left corner of the brake pedal. It has the word PARK molded into it and the words PARK BRAKE marked on top of it (Figure 3-7, Page 3-5). To set the park brake, depress the brake pedal firmly and tilt the park brake portion of the pedal forward with your foot (Figure 3-8, Page 3-5). See following WARNING.

GENERAL INFORMATION Controls and Indicators

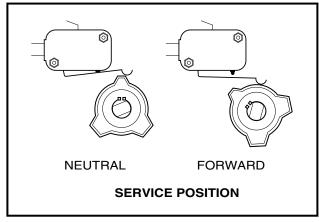
A WARNING

 THE PARK BRAKE WILL RELEASE AUTOMATICALLY WHEN EITHER THE ACCELERATOR OR BRAKE PEDAL IS DEPRESSED. THE PARK BRAKE HAS MULTIPLE LOCKING POSITIONS AND SHOULD BE FIRMLY PRESSED AND LOCKED TO PREVENT THE VEHICLE FROM ROLLING.

GASOLINE VEHICLES ONLY

Neutral Lockout Cam

For the convenience of the trained technician, there is a neutral lockout cam located on the back of the Forward/Reverse handle. If the neutral lockout cam is pulled out approximately 3/8 inch (10 mm) and then rotated one-half turn until it snaps into place, the cam will be in the SERVICE position (Figure 3-9, Page 3-6).



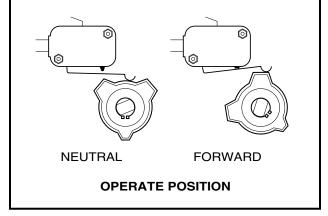


Figure 3-9 Neutral Lockout Cam - Service

Figure 3-10 Neutral Lockout Cam - Operate

This will allow the technician to run the engine in NEUTRAL for certain maintenance procedures. With the cam in this position, the vehicle will not operate if the Forward/Reverse handle is placed in either the FORWARD or REVERSE position. To put cam back into the OPERATE position, pull the cam out approximately 3/8 inch (10 mm) and rotate one-half turn until it snaps into place (Figure 3-10, Page 3-6). See following WARNING and NOTE.

WARNING

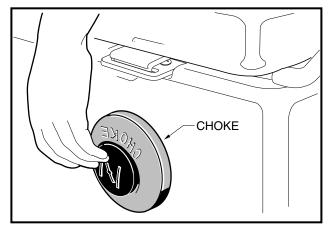
WITH THE CAM IN THE SERVICE POSITION AND THE ENGINE RUNNING, THE VEHICLE MAY
MOVE SUDDENLY IF THE FORWARD/REVERSE HANDLE IS SHIFTED OR ACCIDENTALLY
BUMPED. TO PREVENT THIS, CHOCK THE FRONT AND REAR WHEELS AND ALWAYS FIRMLY
SET THE PARK BRAKE BEFORE SERVICING OR LEAVING THE VEHICLE.

NOTE

• BE SURE TO RETURN THE CAM TO THE OPERATE POSITION AFTER SERVICING THE VEHICLE, OR IT WILL NOT RUN WITH THE FORWARD/REVERSE HANDLE IN EITHER THE FORWARD OR REVERSE POSITION.

Choke

The choke is located on the seat support panel below and to the left of the driver's left knee (**Figure 3-11**, **Page 3-7**). If the vehicle is hard to start in cool or cold temperatures, simply push in the choke button with your left hand. Hold it during start up and release the choke cover after the engine starts and runs smoothly.



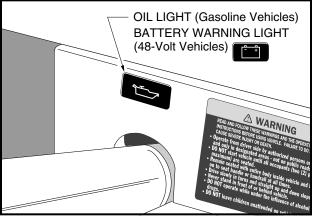


Figure 3-11 Choke Button

Figure 3-12 Dash Warning Light

Oil Light

The DS Gasoline golf car is equipped with a low oil warning light, located on the dash panel just above the steering column (Figure 3-12, Page 3-7). If the oil warning light comes on, oil should be checked and added to the engine as necessary before continuing to use the vehicle. The vehicle should never be driven when the oil warning light remains on. If the oil warning light goes on and off, you may proceed, but oil should be added at the first opportunity. If oil level is correct and the light stays on, have a trained technician check the vehicle.

CAUTION

• FAILURE TO ADD OIL IMMEDIATELY WHEN THE OIL WARNING LIGHT STAYS ON MAY RESULT IN PERMANENT ENGINE DAMAGE.

POWERDRIVE SYSTEM 48 AND POWERDRIVE PLUS ELECTRIC VEHICLES ONLY **Battery Warning Light**

PowerDrive System 48 and PowerDrive Plus vehicles feature a dash mounted battery warning light that, when the vehicle is in operation, indicates low battery voltage, or, when vehicle is being charged, indicates a charging problem (Figure 3-12, Page 3-7). The battery warning light is controlled by the PowerDrive onboard computer.

When the vehicle is in operation, the warning light will repeatedly illuminate for 10 seconds, with 4 second intervals. if:

- Batteries' voltage drops below 48 when there is no load on the batteries (the vehicle is stopped and there are no accessories on).
- Batteries have discharged to less than 25% of their capacity.

If the warning light illuminates during a round of golf, there is enough power remaining to finish the round, but the car should be charged before being used again. If the warning light comes on and the vehicle is unable to finish the round, have a Club Car distributor/dealer check the vehicle for a possible battery or electrical system problem.

When the batteries receive an incomplete charge because 1) the DC power cord is disconnected, 2) AC power to the charger is interrupted, 3) automatic charger shut-off occurs after 16 hours of operation, or 4) the charger malfunctions, the warning light will indicate as follows:

• The warning light will not illuminate if the charge is 90% or more complete. The onboard computer will retain in memory the amount of charge needed to fully replenish the batteries and will complete the charge during the next charge cycle.

GENERAL INFORMATION Controls and Indicators

Battery Warning Light, Continued:

When the charger is unplugged, the warning light will illuminate and remain illuminated for 10 seconds if the
charge is less than 90% complete but the car has enough power to complete 36 holes of golf. This will alert
the fleet operator that the car may be used, but that it must be charged to completion as soon as possible.

- The warning light will repeatedly illuminate for 10 seconds, with 4 second intervals, if the charger times
 out at 16 hours (see charger manual) and the batteries are not sufficiently charged. This indicates an
 abnormal charge cycle. Charger and batteries should be checked by your Club Car distributor/dealer.
- The warning light will repeatedly illuminate for 10 seconds, with 4 second intervals, during a charge cycle (DC plug is still connected) if AC power to the charger is interrupted. The light will go out when AC power is restored.

LED Light: In addition to the warning light, there is an infrared LED in the dash light assembly which transmits an infrared signal from the OBC. This signal is received by the optional Communication Display Module which provides information on the condition of the vehicle and batteries.

POWERDRIVE PLUS ELECTRIC VEHICLES ONLY

Tow/Run Switch

A WARNING

- TO AVOID POSSIBLE BATTERY EXPLOSION, THE TOW/RUN SWITCH MUST BE IN THE **TOW** POSITION BEFORE DISCONNECTING OR CONNECTING BATTERY WIRES.
- WHEN THE TOW/RUN SWITCH IS IN THE **TOW** POSITION, ALL MOTOR BRAKING FUNCTIONS, INCLUDING ZERO-SPEED DETECT, ARE DISABLED.

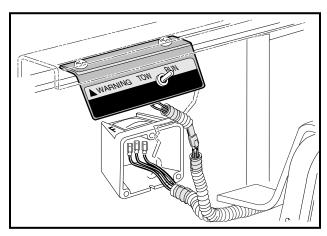


Figure 3-13 Tow/Run Switch

All DS PowerDrive Plus vehicles are equipped with a Tow/Run switch, located under the seat just above the Forward/Reverse rocker switch (Figure 3-13, Page 3-8). The Tow/Run switch must be in the RUN position in order to operate the vehicle. When the switch is in the TOW position, power to the vehicle electrical components is turned off and the vehicle will not operate. See following NOTE.

NOTE

- AFTER PLACING THE SWITCH IN TOW POSITION, ALLOW 10 SECONDS BEFORE SWITCHING BACK TO RUN.
- AFTER PLACING THE SWITCH IN THE **RUN** POSITION, ALLOW 10 SECONDS BEFORE OPERATING THE VEHICLE.

The Tow/Run switch should be placed in the TOW position under the following conditions:

• Before Towing the Vehicle: Place the Tow/Run switch in the TOW position to disable all motor braking functions, thus preventing possible damage that could occur to the vehicle or electrical components if the vehicle is towed while the Zero-Speed Detect motor braking function is operating.

- Before Disconnecting or Attaching Battery Wires: Place the Tow/Run switch in the TOW position to turn off power to the vehicle electrical system, thus preventing severe arcing and possible battery explosion as the battery wires are disconnected.
- For Long Term Storage: Place the Tow/Run switch in the TOW position to turn off power to the vehicle electrical system, minimizing vehicle electrical components from discharging the batteries.

DRIVING INSTRUCTIONS

A WARNING

- ONLY LICENSED DRIVERS SHOULD BE ALLOWED TO DRIVE THIS VEHICLE.
- IF RENTING OR LOANING VEHICLE. MAKE SURE DRIVER IS FAMILIAR WITH ALL CONTROLS. AND OPERATING PROCEDURES BEFORE ALLOWING THE VEHICLE TO BE DRIVEN.
- NO MORE THAN TWO PEOPLE SHOULD BE ON THE VEHICLE AT ONE TIME.
- THE VEHICLE IS NOT SPECIALLY EQUIPPED FOR HANDICAPPED PERSONS. BE SURE ALL PERSONS CAN PROPERLY OPERATE THE VEHICLE PRIOR TO ALLOWING THEM TO DRIVE THE VEHICLE.
- FOR NIGHT USE, THE VEHICLE MUST BE EQUIPPED WITH HEADLIGHTS, TAILLIGHTS, AND REFLECTORS.
- STOP THE VEHICLE BEFORE SHIFTING THE FORWARD/REVERSE HANDLE. FAILURE TO DO SO MAY RESULT IN INJURY TO AN UNSUSPECTING PASSENGER AND (OR) DAMAGE TO THE VEHICLE. A BUZZER WILL SOUND AS A WARNING WHEN THE VEHICLE IS IN REVERSE.
- TO AVOID BEING STRUCK, DO NOT STAND IN FRONT OF OR BEHIND THE VEHICLE.

WHEN DRIVING THE VEHICLE:

- OPERATE THE VEHICLE FROM THE DRIVER'S SEAT ONLY.
- TO PREVENT FALLS FROM THE VEHICLE, REMAIN SEATED IN A MOVING VEHICLE AND HOLD ON TO SEAT HANDLES OR HANDRAILS AT ALL TIMES. DRIVER SHOULD KEEP BOTH HANDS ON THE STEERING WHEEL WHEN THE VEHICLE IS IN MOTION.
- TO PREVENT THE POSSIBILITY OF SERIOUS INJURY, KEEP ENTIRE BODY INSIDE THE VEHICLE.
- TO PREVENT OVERTURNING THE VEHICLE, DRIVE SLOWLY IN TURNS.
- TO PREVENT OVERTURNING THE VEHICLE, DRIVE SLOWLY STRAIGHT UP AND DOWN SLOPES. DO NOT DRIVE THE VEHICLE ON SLOPES EXCEEDING 20% INCLINE.
- TO AVOID POSSIBLE INJURY TO AN UNSUSPECTING PASSENGER AND (OR) DAMAGE TO THE VEHICLE, AVOID SUDDEN STARTS, SUDDEN STOPS, AND ABRUPT TURNS.
- TO AVOID THE POSSIBILITY OF LOSING CONTROL OF OR OVERTURNING VEHICLE, REDUCE SPEED FOR ADVERSE DRIVING CONDITIONS SUCH AS WET GRASS OR ROUGH TERRAIN.
- DO NOT USE THE VEHICLE ON PUBLIC ROADS. IT IS NOT DESIGNED OR INTENDED FOR STREET USE AND SHOULD NOT BE LICENSED FOR USE ON PUBLIC ROADS.
- OBEY ALL LOCAL RULES CONCERNING GOLF CARS.
- THE VEHICLE SHOULD BE DRIVEN IN ONLY SPECIFIED AREAS BY TRAINED DRIVERS.
- DO NOT DRIVE WHILE UNDER THE INFLUENCE OF ALCOHOL, DRUGS, OR MEDICATIONS.

GENERAL INFORMATION Driving Instructions

Driving Instructions, Continued:

No one should drive the vehicle without first being instructed in the proper operation and use of the vehicle controls. An experienced operator should accompany each first-time driver on a test drive before allowing him (her) to operate the vehicle alone.

To ensure safe operation of the vehicle, follow exactly and in order, all of the following procedures. Read and understand all instructions prior to driving the vehicle.

STARTING THE VEHICLE

- 1. Study and understand controls.
- 2. Make sure everyone is seated and holding onto seat handles or handrails.
- 3. Read safety warnings located on dash and (or) above pedals.
- 4. Make sure wheels are turned in desired direction.
- 5. Turn key to the ON position and be sure nothing is in your path.
- 6. Select direction by placing Forward/Reverse handle in desired position (F = forward or R = reverse). A buzzer will sound as a warning when the vehicle is in REVERSE.
- Slowly depress accelerator pedal. The park brake will release automatically and the vehicle will start to
 move. As the accelerator pedal is depressed, speed will increase until full speed is reached. See following WARNING.

WARNING

• VEHICLE OPERATOR MUST CONTROL SPEED WHEN GOING DOWNHILL.

GASOLINE VEHICLE ONLY:

- NEVER SHIFT THE VEHICLE OUT OF **FORWARD** WHILE GOING DOWNHILL. IF YOU DO, YOU WILL NOT BE ABLE TO SHIFT INTO **REVERSE** OR BACK INTO **FORWARD** UNTIL STOPPED.
- DEPRESS THE BRAKE PEDAL AS NECESSARY AND PARTIALLY DEPRESS THE ACCELERATOR WHEN DESCENDING A HILL. WITH THE ACCELERATOR PEDAL PARTIALLY DEPRESSED, THE GOVERNOR WILL CAUSE THE ENGINE TO ASSIST THE BRAKES IN CONTROLLING DOWNHILL SPEED.

POWERDRIVE PLUS VEHICLE ONLY:

 "PEDAL DOWN" OR "PEDAL UP" MOTOR BRAKING MAY BE USED TO CONTROL SPEED WHEN GOING DOWNHILL (SEE PERFORMANCE INSPECTION, PAGE 3-2). HOWEVER, TERRAIN OR OTHER CONDITIONS MAY REQUIRE THAT PEDAL BRAKING BE USED IN CONJUNCTION WITH MOTOR BRAKING.

STOPPING THE VEHICLE

A WARNING

 DRIVING THROUGH WATER MAY AFFECT THE BRAKES. AFTER DRIVING THROUGH WATER, CHECK EFFECTIVENESS OF THE BRAKES BY GENTLY DEPRESSING THE BRAKE PEDAL. IF THE VEHICLE DOES NOT SLOW DOWN AT THE NORMAL RATE, CONTINUE TO DEPRESS THE BRAKE PEDAL UNTIL THE BRAKES DRY OUT AND NORMAL PERFORMANCE RETURNS.

A CAUTION

 WHEN STOPPED ON A HILL, USE THE BRAKE PEDAL TO HOLD YOUR POSITION. DO NOT USE THE ACCELERATOR PEDAL.

Towina

To stop the vehicle, release the accelerator pedal and depress the brake pedal until the vehicle comes to a complete stop.

PARKING AND LEAVING THE VEHICLE

- 1. After stopping vehicle, firmly depress park brake pedal until it locks. This will prevent vehicle from rolling.
- 2. Turn the key switch to OFF and place the shift handle in the NEUTRAL position. Remove the key when the vehicle is not in use.
 - PowerDrive Plus Vehicles Only: When the vehicle Tow/Run switch is in the RUN position, (with the Forward/Reverse handle or key switch in any position), the "zero speed detect" function will prevent the vehicle from rolling at more than 1 or 2 mph unless the accelerator is depressed. This prevents the possibility of a parked vehicle (with the park brake disengaged) rolling away too fast to be overtaken on foot. See "Zero Speed Detect" on Page 3-3.

TOWING

WARNING

- NEVER TOW THE VEHICLE ON PUBLIC STREETS OR HIGHWAYS.
- USE ONLY APPROVED CLUB CAR TOW BARS.
- TURN THE KEY SWITCH TO OFF AND PLACE THE FORWARD/REVERSE HANDLE IN NEUTRAL BEFORE TOWING THE VEHICLE.
- EXTREME CAUTION SHOULD BE USED WHEN TOWING ANY VEHICLE.
- DO NOT EXCEED 5 MPH (8 KPH) TOWING SPEED.
- DO NOT ALLOW PASSENGERS IN THE VEHICLES BEING TOWED.
- AVOID SUDDEN STARTS, SUDDEN STOPS, AND TIGHT TURNS WHEN TOWING.
- DO NOT TOW MORE THAN ONE CLUB CAR VEHICLE WITH ANOTHER CLUB CAR VEHICLE. IF MORE THAN ONE VEHICLE MUST BE TOWED, USE AN ADEQUATELY POWERED VEHICLE (TRACTOR OR FULL SIZED TRUCK) PROPERLY FITTED, WITH A TOW HITCH HEIGHT OF 11 INCHES. ONLY HEAVY-DUTY TOW BARS SHOULD BE USED FOR MULTI-VEHICLE TOWING. NEVER TOW MORE THAN FIVE VEHICLES AT ONE TIME.
- POWERDRIVE PLUS VEHICLE ONLY: PLACE THE TOW/RUN SWITCH IN THE TOW POSITION. THE VEHICLE WILL NOT ROLL OTHERWISE.

All vehicles are equipped with both front and rear tow bar attaching points. A light duty tow bar is available for break-down towing and single vehicle towing. A heavy duty detachable tow bar and a heavy duty onboard tow bar are available for multi-vehicle towing. Observe all of the above warning statements when towing.

TRANSPORTING ON A TRAILER

If the vehicle must be transported over long distances or on public highways, it should be done on an approved trailer. See following WARNIING:

WARNING

- DO NOT ALLOW PEOPLE IN THE TRAILER BEING TOWED.
- AVOID SUDDEN STARTS, SUDDEN STOPS AND TIGHT TURNS WHEN TOWING. WARNING CONTINUED ON NEXT PAGE . . .

GENERAL INFORMATION Storage—Gasoline Vehicle

WARNING

 AVOID STOPPING ON A HILL WHEN TOWING. IF YOU MUST STOP ON A HILL, AVOID SUDDEN STARTS OR ROLLING BACKWARDS AND STOPPING SUDDENLY. FAILURE TO HEED THIS WARNING COULD CAUSE THE VEHICLE TO OVERTURN, POSSIBLY RESULTING IN SEVERE PERSONAL INJURY.

- FOR USE ON PUBLIC ROADS, THE TRAILER MUST MEET ALL FEDERAL, STATE, AND LOCAL REQUIREMENTS SUCH AS TAILLIGHTS, BRAKE LIGHTS, ETC.
- NEVER TOW A CLUB CAR VEHICLE BEHIND A PASSENGER VEHICLE OR TRUCK ON A PUBLIC ROAD UNLESS IT IS ON AN APPROVED TRAILER.
- ALWAYS USE AN APPROVED TRAILER THAT HAS A LOAD RATING OF 1200 LB. (544 KG) PER VEHICLE TO BE TOWED (EXAMPLE: A TWO-CAR TRAILER SHOULD BE RATED AT 2 X 1200 = 2400 LB. (2 X 544 = 1088 KG)).
- THE VEHICLE TO BE TOWED SHOULD BE TIED SECURELY TO THE TRAILER, WITH THE FORWARD/REVERSE HANDLE IN **NEUTRAL**, THE KEY SWITCH **OFF**, AND THE PARK BRAKE FIRMLY DEPRESSED AND LOCKED.
- WHEN TOWING ON A TRAILER, REDUCE NORMAL ROAD SPEED OF THE TOW VEHICLE.
- BECAUSE OF ADDED LENGTH OF THE TRAILER, USE CAUTION WHEN TURNING A CORNER.
- REMOVE THE VEHICLE WINDSHIELD BEFORE TRANSPORTING ON A TRAILER.
- GASOLINE VEHICLE ONLY: TURN FUEL SHUT-OFF VALVE TO OFF (FIGURE 3-14, PAGE 3-13).

STORAGE-GASOLINE VEHICLE

See DANGER and WARNING in Section 1–Safety.

To prepare your vehicle for extended off season storage:

1. Store vehicle in a cool place. This will prevent self-discharge of the battery. If the battery appears to be weak, have it charged using an automotive-type 12-volt battery charger rated at 10 amps or less.

A DANGER

- NEVER ATTEMPT TO DRAIN GASOLINE WHEN THE ENGINE IS HOT OR WHILE IT IS RUNNING. BE SURE TO CLEAN UP ANY SPILLED GASOLINE BEFORE OPERATING VEHICLE.
- STORE GASOLINE IN AN APPROVED GASOLINE CONTAINER ONLY. STORE IN A WELL-VENTILATED AREA AWAY FROM SPARKS, OPEN FLAMES, HEATERS, OR HEAT SOURCES.
- DO NOT SERVICE, REPAIR, OR OPERATE IN AN ENCLOSED AREA WITHOUT PROPER VENTILATION. THE ENGINE PRODUCES CARBON MONOXIDE WHICH IS AN ODORLESS, DEADLY POISON.
- KEEP GASOLINE OUT OF THE REACH OF CHILDREN.
- DO NOT SIPHON GASOLINE FROM THE VEHICLE.

WARNING

- TURN THE KEY SWITCH **OFF**, REMOVE THE KEY, AND LEAVE THE FORWARD/REVERSE HANDLE IN THE **NEUTRAL** POSITION DURING STORAGE. THIS IS TO PREVENT UNINTENTIONALLY STARTING THE VEHICLE.
- DO NOT ATTEMPT TO CHARGE A BATTERY IF IT IS FROZEN OR IF THE CASE IS BULGED. DISCARD THE BATTERY. FROZEN BATTERIES CAN EXPLODE.

A CAUTION

BATTERIES IN A LOW STATE OF CHARGE WILL FREEZE AT LOW TEMPERATURES.

2. Drain carburetor.

- 2.1. Place the Forward/Reverse handle in the NEUTRAL position and the neutral lockout cam in the SERVICE position. Turn the fuel shut-off valve to the closed (OFF) position and run the engine until fuel remaining in the carburetor and fuel lines is used up and the engine stalls. Return the neutral lockout cam to OPERATE position.
- 2.2. Loosen (do not remove) carburetor drain screw and drain fuel remaining in bowl into a small container, then pour fuel from the container into vehicle fuel tank. Retighten carburetor drain screw.
- 2.3. Disconnect fuel vent line from fuel tank vent nipple.
- 2.4. Plug the fuel tank vent nipple so that it is air tight. We recommend using a slip-on vinyl cap.
- 3. To protect the engine, remove the spark plug and pour 1/2 ounce of SAE 10 weight oil into the engine through the spark plug hole. Rotate the engine crankshaft by hand several times and then re-install spark plug.
- 4. Increase tire pressure to 20 psi (137.9 kPa).
- 5. Grease front suspension and do all quarterly periodic lubrication. See Periodic Lubrication Schedule, Section 10-Periodic Maintenance, in the appropriate Maintenance and Service Supplement.
- 6. Thoroughly clean front body, rear body, seats, engine compartment, and underside of vehicle.
- 7. Do not latch the park brake. Chock wheels to prevent the vehicle from rolling.

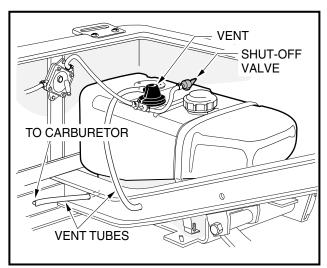


Figure 3-14 Fuel Tank, Vent, and Lines

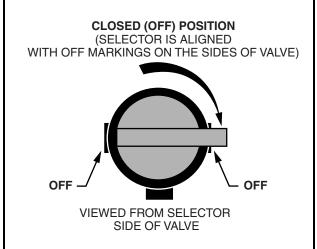


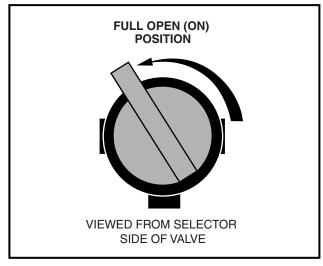
Figure 3-15 Fuel Shut-Off Valve Closed Position

TO RETURN THE STORED VEHICLE TO SERVICE

- 1. Restore fuel system to operation.
 - 1.1. Remove plug from the fuel tank vent nipple and connect the vent line to the nipple. Open fuel shut-off valve.
 - 1.2. Place the Forward/Reverse handle in the NEUTRAL position and the neutral lockout cam in the SERVICE position. Crank the engine until fuel is pumped into the carburetor and fuel lines and the engine starts. Turn engine off and return neutral lockout cam to the OPERATE position.
- 2. Readjust tire pressure to 12 -14 psi (83-96 kPa).

GENERAL INFORMATION Storage—Electric Vehicle

To Return the Stored Vehicle to Service, Continued:



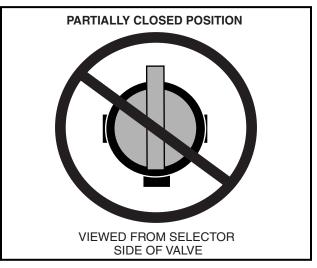


Figure 3-16 Fuel Shut-Off Valve-Open Position

Figure 3-17 Incorrect Fuel Shut-off Valve Setting

3. Perform the Pre-Operation Checklist. See page 3-2.

NOTE

 DUE TO THE OIL ADDED TO THE ENGINE IN PREPARATION FOR STORAGE, THE ENGINE MAY SMOKE EXCESSIVELY FOR A SHORT WHILE WHEN RUNNING IT FOR THE FIRST TIME AFTER STORAGE.

STORAGE-ELECTRIC VEHICLE

See DANGER and WARNING in Section 1–Safety.

To prepare your vehicle for extended off season storage:

WARNING

- TURN THE KEY SWITCH **OFF**, REMOVE THE KEY, AND LEAVE THE FORWARD/REVERSE HANDLE IN THE **NEUTRAL** POSITION DURING STORAGE. THIS IS TO PREVENT UNINTENTIONALLY STARTING THE VEHICLE.
- DO NOT ATTEMPT TO CHARGE FROZEN BATTERIES OR BATTERIES WITH BULGED CASES. DISCARD THE BATTERY, FROZEN BATTERIES CAN EXPLODE.

A CAUTION

- BATTERIES IN LOW STATE OF CHARGE WILL FREEZE AT LOW TEMPERATURES.
- WHEN WASHING THE VEHICLE, DO NOT DIRECT WATER STREAM AT THE MULTI-STEP POTENTIOMETER (48-VOLT VEHICLES) OR V-GLIDE SPEED SWITCH (36-VOLT VEHICLE), FORWARD AND REVERSE SWITCH, OR OTHER ELECTRICAL COMPONENT.
- IF BATTERY WIRE TERMINALS ARE DAMAGED OR CORRODED, THEY SHOULD BE REPLACED OR CLEANED AS NECESSARY. FAILURE TO DO SO MAY CAUSE THEM TO OVERHEAT DURING OPERATION.
- POWERDRIVE PLUS VEHICLES ONLY: PLACE TOW/RUN SWITCH IN THE TOW POSITION.

- 1. Fully charge batteries. See Section 13-Batteries, in the appropriate Maintenance and Service Supplement.
- 2. Wash off any corrosion around the terminals with a solution of baking soda and water (one cup per gallon of water), then rinse solution from the batteries (do not allow this solution to enter the batteries). Let the terminals dry and coat them with Battery Terminal Spray, Club Car Part No. 1014305.
- 3. Store in a cool, dry place. This will minimize self-discharge of the batteries.
- 4. Adjust tire pressure to 20 psi (137.9 kPa).
- 5. Grease front suspension and do all quarterly periodic lubrication. See Periodic Lubrication Schedule, Section 10-Periodic Maintenance, in the appropriate Maintenance and Service Supplement.
- 6. Thoroughly clean front body, rear body, seats, battery compartment, and underside of vehicle.
- 7. Do not latch the park brake. Chock wheels to prevent the vehicle from rolling.
- 8. Keep batteries fully charged during storage. See Section 13-Batteries, in the appropriate Maintenance and Service Supplement.
- Charge 36-volt vehicles with Accu-Power battery chargers every 6-8 weeks as necessary. If it is not possible or practical to charge the batteries, leave them disconnected while the vehicle is in storage.
- Leave PowerDrive System 48 and PowerDrive Plus vehicles with PowerDrive chargers plugged in during storage. The PowerDrive storage charge feature will automatically charge the batteries as needed throughout storage period. See following NOTE

NOTE

- A POWERDRIVE SYSTEM 48 OR POWERDRIVE PLUS VEHICLE WILL NOT OPERATE WHILE PLUGGED TO A CHARGER.
- IF CHARGER CANNOT REMAIN PLUGGED IN DURING LONG TERM STORAGE, DISCONNECT BATTERY CABLES AS SHOWN IN SECTION 1-SAFETY.

TO RETURN THE STORED VEHICLE TO SERVICE

- 1. Fully charge batteries. See Section 13-Batteries, in the appropriate Maintenance and Service Supplement.
- 2. Readjust tire pressure to 18-20 psi (124.1–137.9 kPa).
- 3. Perform the Pre-Operation Checklist. See page 3-2.

SECTION 4-BODY AND TRIM

WARNING

- ONLY TRAINED TECHNICIANS SHOULD REPAIR OR SERVICE THIS VEHICLE. ANYONE DOING EVEN SIMPLE REPAIRS OR SERVICE SHOULD HAVE KNOWLEDGE AND EXPERIENCE IN ELECTRICAL AND MECHANICAL REPAIR. FOLLOW ALL PROCEDURES EXACTLY.
- HEED **DANGER**, **WARNING**, AND **CAUTION** STATEMENTS IN THIS MANUAL, AS WELL AS MANUFACTURERS' WARNINGS ON BODY REPAIR AND CLEANING PRODUCTS.
- WEAR SAFETY GLASSES OR APPROVED EYE PROTECTION WHILE SERVICING THE VEHICLE. WEAR A FULL FACE SHIELD WHEN WORKING WITH BATTERIES.
- WEAR A RESPIRATOR APPROVED FOR DUST AND MIST WHEN CUTTING, SANDING, PAINTING, OR REPAIRING BODY PANELS.
- DO NOT SWALLOW OR INHALE CLEANING PRODUCTS. USE IN A WELL-VENTILATED AREA.
- WEAR PROTECTIVE GLOVES. CLEANING PRODUCTS MAY BE HARMFUL OR IRRITATING TO SKIN.
- TURN KEY SWITCH **OFF**, PLACE FORWARD/REVERSE HANDLE IN THE **NEUTRAL** POSITION, AND REMOVE KEY BEFORE SERVICING THE VEHICLE.
- DO NOT WEAR LOOSE CLOTHING. REMOVE JEWELRY SUCH AS RINGS, WATCHES, CHAINS, ETC. WHEN SERVICING VEHICLE.
- USE INSULATED TOOLS WHEN WORKING NEAR BATTERIES OR ELECTRICAL CONNECTIONS. USE EXTREME CAUTION TO AVOID SHORTING OF COMPONENTS OR WIRING.
- MOVING PARTS! DO NOT ATTEMPT TO SERVICE VEHICLE WITH ENGINE/MOTOR RUNNING.
- HOT! DO NOT ATTEMPT TO SERVICE VEHICLE WITH HOT MOTOR, RESISTORS, ENGINE, OR EXHAUST SYSTEM. FAILURE TO HEED THIS WARNING COULD RESULT IN SEVERE BURNS.

GASOLINE VEHICLE:

- TO AVOID UNINTENTIONALLY STARTING THE VEHICLE:
 - DISCONNECT THE BATTERY CABLES, NEGATIVE (-) FIRST (SEE SECTION 1, FIGURE 1-1).
 - DISCONNECT THE SPARK PLUG WIRE FROM THE PLUG.
- FRAME GROUND DO NOT ALLOW TOOLS OR OTHER METAL OBJECTS TO CONTACT FRAME WHEN DISCONNECTING BATTERY CABLES OR OTHER ELECTRIC WIRING. NEVER ALLOW A POSITIVE WIRE TO TOUCH THE VEHICLE FRAME, ENGINE, OR OTHER METAL COMPONENT.

ELECTRIC VEHICLE:

- TO AVOID UNINTENTIONALLY STARTING THE VEHICLE, DISCONNECT BATTERIES AS SHOWN (SECTION 1, FIGURE 1-2 OR 1-3).
- ON POWERDRIVE PLUS VEHICLES, PLACE TOW SWITCH IN THE *TOW* POSITION **BEFORE** DISCONNECTING BATTERIES.
- DISCHARGE THE CONTROLLER AS FOLLOWS AFTER DISCONNECTING BATTERIES:
 - TURN THE KEY SWITCH TO **ON** AND PLACE THE FORWARD/REVERSE HANDLE IN THE **REVERSE** POSITION.
 - SLOWLY DEPRESS THE ACCELERATOR PEDAL AND KEEP IT DEPRESSED UNTIL THE REVERSE WARNING BUZZER CAN NO LONGER BE HEARD. WHEN THE BUZZER STOPS SOUNDING, THE CONTROLLER IS DISCHARGED.

BODY AND TRIM Cleaning the Vehicle

A CAUTION

• DO NOT USE DETERGENTS OR CLEANING SOLVENTS THAT CONTAIN AMMONIA, AROMATIC SOLVENTS, OR ALKALI MATERIALS ON BODY PANELS OR SEATS.

- DO NOT ALLOW BATTERY ACID TO DRIP ON BODY PANELS. BATTERY ACID WILL CAUSE PERMANENT BLEMISHES. WASH ACID OFF BODY PANELS IMMEDIATELY.
- DO NOT ALLOW CLEANING PRODUCTS TO CONTACT CLOTHES OR VEHICLE SURFACES OTHER THAN THOSE FOR WHICH CLEANING PRODUCTS ARE INTENDED.

CLEANING THE VEHICLE

Club Car DS vehicles are equipped with ArmorFlex[®] front and rear bodies. Use only commercially available automotive cleaners with a sponge or soft cloth for normal cleaning. A garden hose at normal residential water pressure is adequate.

Club Car does not recommend any type of pressure washing or steam cleaning. Such a process (especially if the vehicle has an ArmorFlex rear body that is removed) will expose electrical components to moisture. Moisture entering electrical components can result in water damage and subsequent component failure.

Use non-abrasive wax products. Battery acid, fertilizers, tars, asphalt, creosote, paint, or chewing gum should be removed immediately to prevent possible stains.

The seats of the vehicle will last longer with proper cleaning. Use a solution of 10% liquid soap and warm water applied with a soft cloth. For imbedded dirt, a soft bristle brush may be used. For heavy soiling, difficult stains or scratches, blemishes, or other body damage, see Section 4 of the Maintenance and Service Manual.

NOTE

• DISPOSE OF WASTE WATER PROPERLY.

SEAT

Proper cleaning of the seat will make it last longer. Use the following guidelines:

Light Soiling: A solution of 10% liquid dish soap and warm water applied with a soft, damp cloth is recommended. For imbedded dirt, a soft bristle brush may be used. Wipe away residue with a water dampened cloth.

For Difficult Stains:

- Dampen a soft, white cloth with a solution of 10% household bleach (sodium hypochlorite) and 90% water. Rub gently to remove stain, then rinse with a water dampened cloth to remove bleach concentration.
- For still more difficult stains, perform previous procedure using full-strength bleach; or allow bleach to puddle on affected area for approximately 30 minutes. Rinse with a water dampened cloth to remove any remaining bleach concentration.

NOTE

 TO PREVENT DAMAGE TO THE VEHICLE WHEN REMOVING DIFFICULT STAINS OR HEAVY SOILING, REMOVE THE SEAT BOTTOM FROM THE VEHICLE FIRST.

FRONT AND REAR BODY REPAIR

STRESS LINES OR STREAKS

Repeated flexing of the body can cause white stress lines or streaks in the finish. To remove them:

- 1. Hold a heat gun 12 inches (30 cm) away from the affected area, with the gun on its lowest heat setting.
- 2. Slowly wave the heat gun back and forth over the affected area until the streak fades.
- 3. It may be necessary to move the gun closer to the body to fade the streak, but under no circumstance should the gun be held closer than 6 inches (15 cm) to the body.

A CAUTION

 HOLDING THE HEAT GUN TOO CLOSE TO THE BODY COULD MELT THE BODY OR DAMAGE THE FINISH SURFACE.

MINOR IMPACT DAMAGE/DEFORMATIONS

Deformations in the body can be repaired using a procedure similar to the one used to remove stress lines. To remove deformations resulting from minor impact damage:

- 1. Hold a heat gun 12 inches (30 cm) away from the affected area, with the gun on its lowest heat setting.
- 2. Periodically remove the heat gun and bend the body, using a push block, in the opposite direction of the deformation.
- 3. Continue heating and bending the body until the original shape returns. Under no circumstance should the gun be held closer than 6 inches (15 cm) to the body. **See preceding CAUTION.**

MINOR SCRATCHES AND SURFACE BLEMISHES

For minor scratches or blemishes in the ArmorFlex body that do not penetrate the finish:

- 1. Thoroughly clean the affected area using a strong, non-abrasive detergent and hot water, then clean with Ultra-Kleen[®] Solvent Cleaner to remove any oil-based contaminants.
- 2. Lightly buff imperfection with a clean, soft cloth or buff pad. Do not use any kind of rubbing (abrasive) compound on body assemblies. .
- 3. Wax the entire body part to restore luster and weather protection.

SMALL SCRATCHES THAT CANNOT BE BUFFED OUT

- 1. Thoroughly clean the affected area with alcohol and then dry thoroughly.
- Using 240 grit or finer sandpaper, lightly sand the scratch to feather the edges. Finish sand the scratch with 320 grit or finer paper to remove gloss from the surface. Sand as little body surface as possible beyond the scratch.

A CAUTION

- BE CAREFUL NOT TO SAND COMPLETELY THROUGH FINISH TO THE BODY MATERIAL. IF THE FINISH IS SANDED THROUGH AND THE THERMO PLASTIC OLEFIN (TPO) BODY MATERIAL IS EXPOSED, REFER TO GOUGES, PUNCTURES, TEARS, LARGE SCRATCHES AND ABRASIONS ON PAGE 4-4.
- 3. Using the brush in the bottle cap of the touch-up paint (available from Club Car Service Parts, see color chart below), apply paint to the scratch. Multiple layers of paint may be required to fill the scratch.

BODY AND TRIM Front Body

Small Scratches, Continued:

4. Allow paint to dry completely (approximately 10-20 minutes), then lightly buff the imperfection.

5. Apply wax to the entire body part to restore luster and weather protection.

Club Car Touch-Up Paint Part Numbers			
Beige	1019972-01		
White	1019972-02		
Gray	1019972-04		
Red	1019972-06		
Royal Blue (Pacific Blue)	1019972-08		
Dark Green	1019972-09		
Black	1019972-10		
Classic Blue (Navy)	1019972-11		
Burgundy	1019972-12		

GOUGES, PUNCTURES, TEARS, LARGE SCRATCHES AND ABRASIONS

Touch up is not recommended. Replace the entire body part or have it repaired by a professional paint and body repair shop with experience repairing TPO bodies.

FRONT BODY

See WARNING and CAUTION on pages 4-1 and 4-2.

FRONT BODY REMOVAL

- 1. Remove screws (3) and nylon locknuts (4) to remove front bumper (2) from vehicle frame. Remove blind rivets (5) (Figure 4-1, Page 4-5).
- 2. Remove carriage bolts (10), locknuts (17), and washers (11) from front body trim. Remove screws (16) from top of front body (Figure 4-1, Page 4-5).
- 3. Loosen (do not remove) T-nut screws (12) securing front body trim (9) against front body (Figure 4-1, Page 4-5).
- 4. Pull front body (8) from under front body trim (9) and lift it from the vehicle (Figure 4-1, Page 4-5).

FRONT BODY INSTALLATION

1. Position the front body on vehicle under front body trim (9). Secure front body trim against front body by tightening the six screws (12) into the trim (Figure 4-1, Page 4-5).

NOTE

- IF INSTALLING A NEW FRONT BODY, TWO 5/16 INCH HOLES MUST BE DRILLED AFTER THE BODY HAS BEEN PLACED ON THE VEHICLE. USE THE BODY TRIM (9) AS A GUIDE FOR DRILLING THE HOLES (Figure 4-1, Page 4-5).
- Install carriage bolts (10), washers (11) and locknuts (17) onto front body trim. Tighten carriage bolts to 11 ft-lb (14.9 N-m). Install screws (16) onto top of front body. Tighten screws to 20 in-lb (2.3 N-m) (Figure 4-1, Page 4-5).
- 3. Install blind rivets (5) (Figure 4-1, Page 4-5)
- 4. Mount the bumper onto the vehicle and install screws (3) and locknuts (4). Tighten to 65 in-lb (7.3 N-m) (Figure 4-1, Page 4-5).

Rear Body

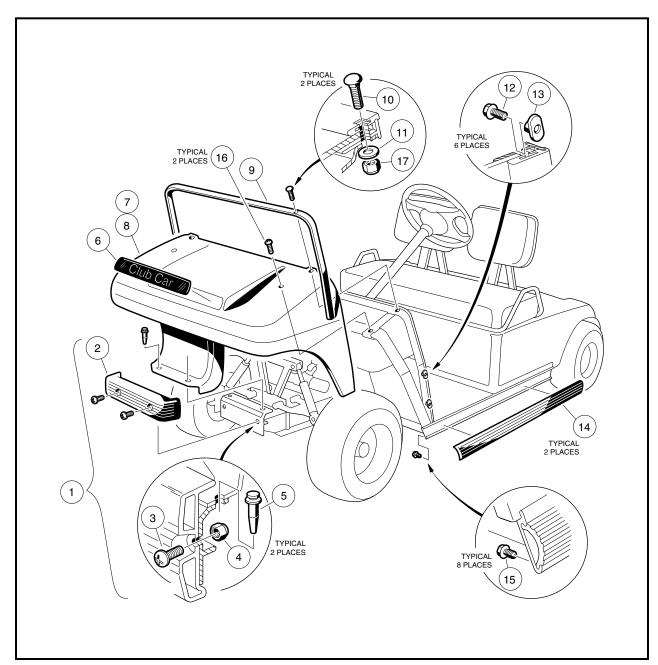


Figure 4-1 Front Body Assembly

REAR BODY

See WARNING and CAUTION on pages 4-1 and 4-2. **REAR BODY REMOVAL**

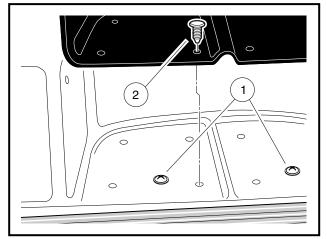
NOTE

REAR BUMPER DOES NOT HAVE TO BE REMOVED TO REMOVE REAR BODY.

BODY AND TRIM

Rear Body

Rear Body Removal, Continued:



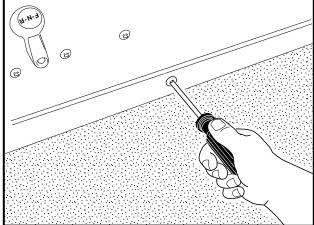
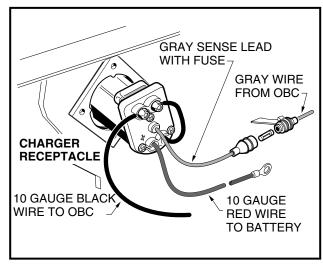


Figure 4-2 Remove Screws Under Bagwell Protector

Figure 4-3 Remove Kick-Plate Screws



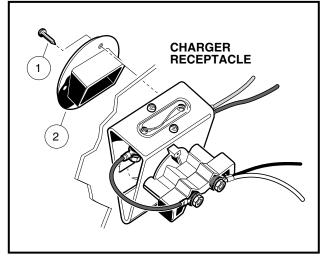


Figure 4-4 PowerDrive Charger Receptacle

Figure 4-5 V-Glide Charger Receptacle

- 1. Remove the seat from the rear body.
- 2. Disconnect battery or batteries, negative cable first.
- 3. Remove bagwell protector by gently pulling the bagwell protector at each plastic barrel (2). (Figure 4-2, Page 4-6).
- 4. Remove the two screws (1), locknuts and washers located under bagwell protector in bagwell floor (Figure 4-2, Page 4-6).
- 5. Remove the two screws, nuts and washers located at the bottom edge of the seat support panel (in kick-plate just above the floormat) (Figure 4-3, Page 4-6).
- 6. **V-Glide Electric, PowerDrive System 48 Electric, and Gasoline vehicles:** Remove the screw securing the Forward/Reverse handle and slide the handle from the shaft.
- 7. Electric vehicles only: Disconnect or remove charger receptacle:
 - PowerDrive System 48 and PowerDrive Plus vehicles (Figure 4-4, Page 4-6):

The charger receptacle must be disconnected, but does not have to be removed from the body:

7.1. Remove wire ties binding 10 gauge red wire (from charger receptacle to battery) to the vehicle frame. Disconnect the 10 gauge red wire at the positive post of battery No. 1.

Rear Body

- 7.2. Remove the retaining nut and disconnect the 10 gauge black wire (from the onboard computer) from the receptacle.
- 7.3. Unplug the fuse holder assembly to disconnect the gray sense lead from the receptacle.

• V-Glide 36-volt vehicles (Figure 4-5, Page 4-6):

- 7.1. Remove the four phillips head screws (1) that secure the receptacle bezel (2) to the rear body.
- 7.2. Remove the bezel from the receptacle and then remove the receptacle from the body. The wires do not have to be disconnected from the receptacle.
- 8. Disconnect and remove Forward/Reverse Switch:

• V-Glide 36-volt and PowerDrive System 48 vehicles:

8.1. Remove three screws, plastic washers and nylon locknuts securing the Forward/Reverse switch to the rear body, then pull the Forward/Reverse switch from the body and place it on the vehicle frame I-beam (with wiring intact).

• PowerDrive Plus vehicles only:

- 8.1. Remove the three wires from the back of the Forward/Reverse switch housing after removing the three self-tapping mounting screws and removing the Forward/Reverse switch.
- Gasoline vehicles only:

NOTE

- TO REMOVE THE REAR BODY, THE CHOKE BUTTON ASSEMBLY DOES NOT HAVE TO BE REMOVED FROM THE BODY. HOWEVER, ADJUSTMENT OF THE CHOKE POSITIONER MAY BE NECESSARY AFTER THE REAR BODY IS REINSTALLED.
 - 8.1. Remove four screws and nylon locknuts securing the Forward/Reverse shifter to the rear body. Pull the Forward/Reverse shifter (with wiring and cable assembly still connected) from body and allow it to rest on vehicle frame I-beam.
 - 8.2. Remove the shifter cable from the cable hanger under the driver side seat hinge.
 - 8.3. Remove two nylon locknuts from fuel pump and remove fuel pump from seat support.
- 9. Remove two carriage bolts (1), nuts (2), and washers (3) attaching the rear legs of the seat back support assembly to the body (Figure 4-6, Page 4-8).
- 10. Remove four screws (1), flat washers (2), and spacers (3), attaching the front legs of the seat back support assembly to the body (Figure 4-7, Page 4-8).
- 11. Lift seat back assembly from vehicle. Keep seat back assembly mounting pads (4) (Figure 4-6, Page 4-8).
- 12. Lift the rear body from the vehicle.

REAR BODY INSTALLATION

- 1. Install in reverse order of removal:
 - 1.1. Tighten four screws (1), flat washers (2) and spacers (3), attaching the front legs of the seat back support assembly to the body to 20 in-lb (2.3 N-m) (Figure 4-7, Page 4-8).
 - 1.2. Tighten the two bolts (1), nuts (2) and washers (3), attaching the rear legs of the seat back support assembly to the body to 11 ft-lb (14.9 N-m) (Figure 4-6, Page 4-8).
 - 1.3. Tighten screws and locknuts securing the Forward/Reverse switch or shifter to 33 in-lb (2.8 N-m).
 - 1.4. Install Forward/Reverse handle and tighten to 14 in-lb (1.6 N.m).
 - 1.5. Tighten kick-plate screws, nuts and washers to 50 in-lb (5.6 N-m) (Figure 4-3, Page 4-6).

BODY AND TRIM Floormat

Rear Body Installation, Continued:

1.6. Tighten two screws (1), locknuts and washers under rear body to 33 in-lb (2.8 N-m) (Figure 4-2, Page 4-6).

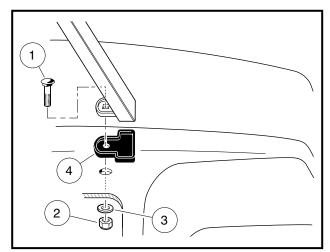
1.7. Gasoline vehicles only: Check the choke positioner for proper adjustment and adjust if necessary. Install fuel pump. See Section 14–Fuel System, in the FE290 Maintenance and Service Supplement.

Electric Vehicles Only:

- 1.8. **36-volt vehicles**: Tighten the four charger receptacle bezel screws (1) to 16 in-lb (1.8 N-m) **(Figure 4-5, Page 4-6)**.
- 1.9. **48-volt vehicles**: Tighten the four charger receptacle bezel screws to 12 in-lb (1.4 N-m). Tighten the nut that secures the 10 gauge black wire to the charger receptacle to 23 in-lb (2.6 N-m).

All Electric Vehicles:

1.10. Tighten the battery connections to 110 in-lb (12.4 N-m) and coat terminals with Battery Protector Spray.



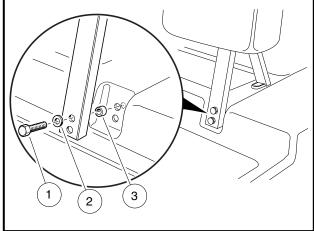


Figure 4-6 Seat Back Support Rear Leg Mounting

Figure 4-7 Seat Back Support Front Leg Mounting

FLOORMAT

FLOORMAT REMOVAL

- 1. Remove the brake and accelerator pedals. See Section 5–Accelerator and Brake Pedal Group.
- 2. Loosen two screws in the rear body kick-plate (Figure 4-3, Page 4-6) and pull the rear edge of the floormat from between the rear body and the floor panel.
- 3. Remove the top edge of the floormat from the overlapping flange under the dash.
- 4. Lift the mat from the vehicle.

FLOORMAT INSTALLATION

- 1. Reverse the removal procedure to install the floormat. Tighten kick-plate screws to 50 in-lb (5.6 N-m).
- 2. Install the brake and accelerator pedals. See Section 5-Accelerator and Brake Pedal Group.

SECTION 5-ACCELERATOR AND BRAKE PEDAL GROUP

A WARNING

- ONLY TRAINED TECHNICIANS SHOULD REPAIR OR SERVICE THE VEHICLE. ANYONE DOING EVEN SIMPLE REPAIRS OR SERVICE SHOULD HAVE KNOWLEDGE AND EXPERIENCE IN ELECTRICAL AND MECHANICAL REPAIR.
- FOLLOW THE PROCEDURES EXACTLY AS STATED IN THIS MANUAL, AND HEED **DANGER**, **WARNING**, AND **CAUTION** STATEMENTS LISTED IN THIS MANUAL AS WELL AS THOSE AFFIXED TO THE VEHICLE.
- IMPROPER USE OF THE VEHICLE OR FAILURE TO PROPERLY MAINTAIN IT, COULD RESULT IN DECREASED VEHICLE PERFORMANCE OR SEVERE PERSONAL INJURY.
- ANY MODIFICATION OR CHANGE TO THE VEHICLE WHICH AFFECTS THE STABILITY OR HANDLING OF THE VEHICLE, OR INCREASES MAXIMUM VEHICLE SPEED BEYOND FACTORY SPECIFICATIONS, COULD RESULT IN SEVERE PERSONAL INJURY OR DEATH.
- WEAR SAFETY GLASSES OR APPROVED EYE PROTECTION WHEN SERVICING THE VEHICLE. WEAR A FULL FACE SHIELD WHEN WORKING WITH BATTERIES.
- DO NOT WEAR LOOSE CLOTHING. REMOVE JEWELRY SUCH AS RINGS, WATCHES, CHAINS, ETC. BEFORE SERVICING VEHICLE.
- MOVING PARTS! DO NOT ATTEMPT TO SERVICE THE VEHICLE WHILE IT IS RUNNING.
- HOT! DO NOT ATTEMPT TO SERVICE HOT MOTOR, RESISTORS, ENGINE, OR EXHAUST SYSTEMS. FAILURE TO HEED THIS WARNING COULD RESULT IN SEVERE BURNS.
- USE INSULATED TOOLS WHEN WORKING AROUND BATTERIES OR ELECTRICAL CONNECTIONS. USE EXTREME CAUTION TO AVOID SHORTING OF COMPONENTS OR WIRING.
- LIFT ONLY ONE END OF VEHICLE AT A TIME. BEFORE LIFTING, LOCK THE BRAKES AND CHOCK THE WHEELS THAT REMAIN ON THE FLOOR. USE A SUITABLE LIFTING DEVICE (CHAIN HOIST OR HYDRAULIC FLOOR JACK) WITH 1000 LB. (454 KG.) MINIMUM LIFTING CAPACITY. DO NOT USE LIFTING DEVICE TO HOLD VEHICLE IN RAISED POSITION. ALWAYS USE APPROVED JACKSTANDS OF PROPER WEIGHT CAPACITY TO SUPPORT VEHICLE.
- TURN THE KEY SWITCH TO **OFF**, REMOVE THE KEY, CHOCK THE WHEELS, PLACE THE FORWARD/REVERSE HANDLE IN **NEUTRAL**, AND DISCONNECT BATTERY(IES) PRIOR TO SERVICING THE VEHICLE.

GASOLINE VEHICLES ONLY:

- TO AVOID UNINTENTIONALLY STARTING THE VEHICLE:
 - DISCONNECT BATTERY CABLES, NEGATIVE (-) FIRST (FIGURE 1-1, PAGE 1-3).
 - DISCONNECT THE SPARK PLUG WIRE FROM THE SPARK PLUG.
- FRAME GROUND DO NOT ALLOW TOOLS OR OTHER METAL OBJECTS TO CONTACT FRAME WHEN DISCONNECTING BATTERY CABLES OR OTHER ELECTRIC WIRING. NEVER ALLOW A POSITIVE WIRE TO TOUCH THE VEHICLE FRAME, ENGINE, OR OTHER METAL COMPONENT.

WARNING CONTINUED ON NEXT PAGE . . .

WARNING

ELECTRIC VEHICLES ONLY:

- TO AVOID UNINTENTIONALLY STARTING THE VEHICLE, DISCONNECT BATTERIES AS SHOWN (SECTION 1, FIGURE 1-2 OR 1-3, PAGE 1-3).
- ON POWERDRIVE PLUS VEHICLES, PLACE TOW/RUN SWITCH IN THE **TOW** POSITION **BEFORE** DISCONNECTING BATTERIES.
- ON POWERDRIVE SYSTEM 48 VEHICLES, DISCHARGE THE CONTROLLER AS FOLLOWS **AFTER** DISCONNECTING BATTERIES:
 - TURN THE KEY SWITCH TO **ON** AND PLACE THE FORWARD/REVERSE HANDLE IN THE **REVERSE** POSITION.
 - SLOWLY DEPRESS THE ACCELERATOR PEDAL AND KEEP IT DEPRESSED UNTIL THE REVERSE WARNING BUZZER CAN NO LONGER BE HEARD. WHEN THE BUZZER STOPS SOUNDING, THE CONTROLLER IS DISCHARGED.

PEDAL GROUP ADJUSTMENT

Read WARNING on page 5-1 and 5-2.

- 1. ADJUST BRAKE PEDAL HEIGHT
 - 1.1. Chock wheels and release park brake. Lift rear of vehicle and place jack stands under the axle tubes to support the vehicle.
 - 1.2. To provide slack in the brake cables, loosen the hex nuts (2 and 3) on the brake equalizer rod (1) (Figure 5-1, Page 5-2).
 - 1.3. Loosen the brake stop jam nut (31), then relieve pedal pressure on the stop by pushing down slightly on the pedal. Then adjust the brake stop bumper (22) up or down (Figure 5-2, Page 5-2). Adjusting the bumper upward decreases distance between pedal and floorboard. Adjusting the bumper downward increases distance between pedal and floorboard. Proper brake pedal height is 5 3/4 inches (14.6 cm) ± 1/4 inch (.6 cm) (Figure 5-3, Page 5-3).
 - 1.4. Tighten the jam nut (31) to 8 ft-lb (9.5 N-m) (Figure 5-2, Page 5-2).

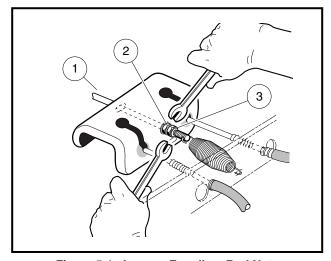


Figure 5-1 Loosen Equalizer Rod Nuts

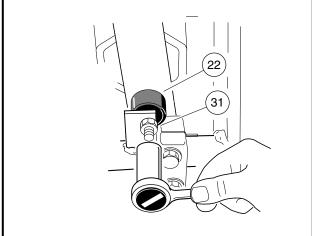


Figure 5-2 Adjust Brake Pedal Height

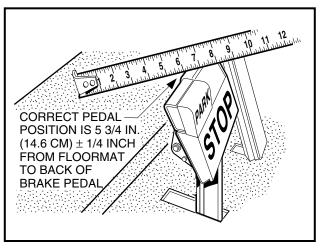


Figure 5-3 Measure Brake Pedal Height

2. ADJUST BRAKE PEDAL FREE PLAY

NOTE

- BRAKE PEDAL FREE PLAY IS THE DISTANCE THE BRAKE PEDAL CAN BE DEPRESSED BEFORE THE BRAKE ACTUATOR ARM (AT THE BRAKE CLUSTER) MOVES.
 - 2.1. Measuring perpendicular from the floorboard to the back of the brake pedal, depress the brake pedal and measure the distance that the pedal moves before all of the slack is taken out of the brake cables (Figure 5-3, Page 5-3).
 - 2.2. Tighten the nut (2) on the equalizer rod (1) so that the brake pedal free play is 1/4 to1/2 inch (6.3 to 12.7 mm) (Figure 5-4, Page 5-3).
 - 2.3. Tighten the jam nut (3) while holding the adjustment nut (2) in the correct position (Figure 5-4, Page 5-3).

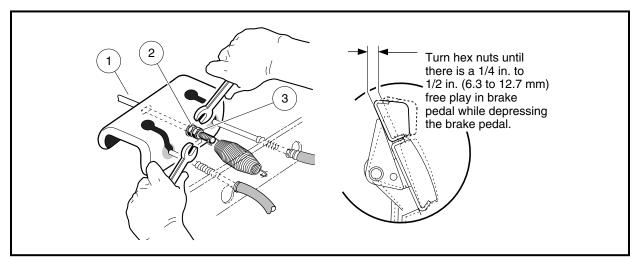


Figure 5-4 Adjust Brake Pedal Free-Play

- 3. ADJUST PARK BRAKE RATCHET/PAWL GAP AND PAWL ENGAGEMENT
 - 3.1. Adjust the retaining nut (7) on the spring support rod until there is a .060 inch gap \pm .030 between the pawl and the tips of the ratchet teeth. Use a feeler gauge to verify the gap (Figure 5-7, Page

5-4). The gap should be consistent through range of pawl movement. If the gap is not consistent, loosen the four bolts (6) **(Figure 5-7, Page 5-4)** securing the accelerator pivot rod supports and adjust the supports. If the gap becomes smaller as the park brake pedal is depressed, move the pivot rod supports slightly rearward until the gap is consistent. If the gap becomes larger as the park brake pedal is depressed, move the pivot rod supports slightly forward until the gap is consistent. **Read following NOTE before proceeding.**

NOTE

- THE ACCELERATOR ROD ADJUSTMENT MUST ALSO BE CHECKED IF THE RATCHET/PAWL GAP IS ADJUSTED (SEE STEP 5, PAGE 5-6, OR STEP 5, PAGE 5-7).
- THE ACCELERATOR ROD MUST BE DISCONNECTED BEFORE PROCEEDING TO STEP 3.2.
 - 3.2. With the park brake unlocked, measure and note the distance from the top of the accelerator pedal to the floorboard, and then lock the park brake (**Figure 5-5**, **Page 5-4**).
 - 3.3. With the park brake locked, make sure that at least 75% of ratchet tooth length engages the pawl (Figure 5-6, Page 5-4). Tooth engagement should be between the two lines marked on the pawl.

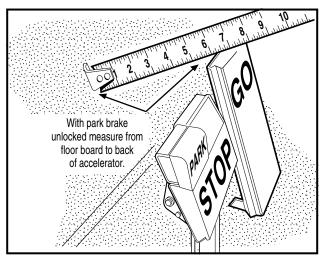


Figure 5-5 Measure Accelerator Pedal Height

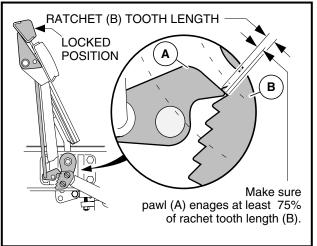


Figure 5-6 Ratchet/Pawl Tooth Engagement

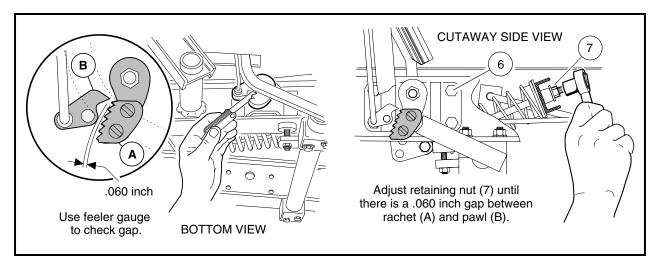
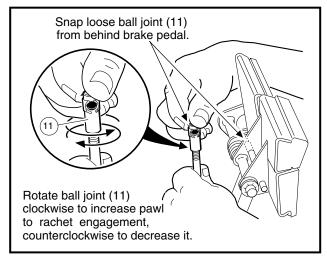


Figure 5-7 Adjust Park Brake Ratchet/Pawl Gap

- 3.4. With the park brake still locked, again measure the distance from the top of the accelerator pedal to the floorboard. If the measurement has changed, ratchet tooth engagement is too deep and must be adjusted.
- 3.5. If ratchet/pawl engagement must be adjusted, disconnect the ball joint at the top of the brake rod and rotate the ball joint sleeve clockwise to increase engagement or counterclockwise to decrease engagement. Reconnect ball joint (Figure 5-8, Page 5-5).
- 3.6. If the accelerator push rod was disconnected from the accelerator pedal, reconnect it.

4. ADJUST ACCELERATOR PEDAL HEIGHT

4.1. Loosen the nut and bolt (Figure 5-9, Page 5-5) securing the accelerator pedal to the pivot plate. Clamp the accelerator pedal adjustment tool (Club Car Part No. 101871001) to the accelerator pedal, with the end marked accelerator pedal height toward the floorboard, then depress the accelerator pedal until the end of the tool rests against the floorboard (pedal height should be 5-5/8 inch). Use a rubber strap to hold pedal in position against the floorboard and then tighten nut to 26 ft-lb (35.3 N-m) (Figure 5-10, Page 5-5).





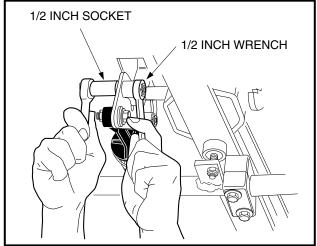


Figure 5-9 Accelerator Pedal Height Adjustment

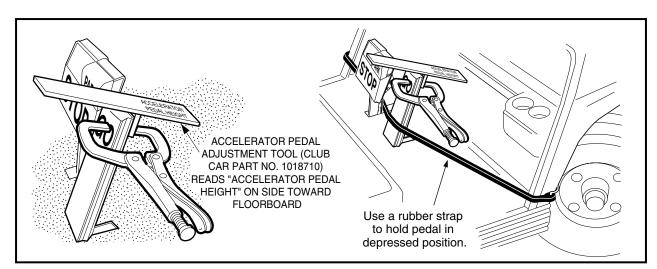


Figure 5-10 Accelerator Pedal Height Adjustment

- 5. ADJUST THE ACCELERATOR ROD
 - For gasoline vehicles, proceed to Step 5.1.
 - For V-Glide 36-volt vehicles, and for PowerDrive System 48 and PowerDrive Plus vehicles, proceed to Page 5-7.

A DANGER

- BEFORE SERVICING, TURN THE KEY SWITCH TO *OFF* AND PLACE THE FORWARD/ REVERSE HANDLE IN THE NEUTRAL POSITION.
- TO PREVENT ACCIDENTALLY STARTING THE VEHICLE, DISCONNECT THE BATTERIES AS INSTRUCTED IN WARNING ON PAGE 5-2. THIS WILL PREVENT THE POSSIBILITY OF THE VEHICLE RUNNING OVER YOU WHEN YOU ARE ADJUSTING THE ACCELERATOR ROD.
- Adjust the Accelerator Rod Gasoline Vehicles Only:
 - 5.1. Remove the electrical box cover.
 - 5.2. Disconnect the accelerator rod (17) at the accelerator pedal, then loosen the jam nuts (18) and adjust the length of the rod (Figure 5-12, Page 5-8) to obtain an accelerator cable cam position of 15°-17° as shown (Figure 5-11, Page 5-6). See following CAUTION.

A CAUTION

- AFTER ACCELERATOR ROD ADJUSTMENT, MAKE SURE THAT APPROXIMATELY THE SAME AMOUNT OF THREAD IS EXPOSED AT EACH END OF THE ROD.
- IF THE LEVER ON THE LIMIT SWITCH IN THE ELECTRICAL BOX IS BENT, REPLACE THE LIMIT SWITCH.
- WHEN LOOSENING OR TIGHTENING JAM NUTS ON THE ACCELERATOR ROD WITH ONE END DISCONNECTED, HOLD THE DISCONNECTED BALL JOINT SLEEVE WITH PLIERS.

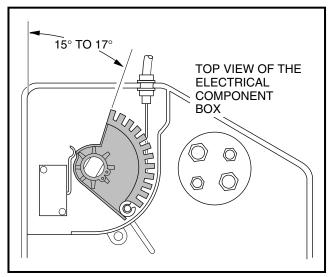


Figure 5-11 Accelerator Cable Cam Position

5.3. Reconnect the accelerator rod at the accelerator pedal.

5.4. Before tightening the jam nuts on the accelerator rod, set the park brake to the first ratchet and pawl position. Depress the accelerator pedal and make sure that the following events occur in the exact order shown:

APPROXIMATE PEDAL TRAVEL **EVENT** (REFERENCE ONLY)

2° - 4° Park Brake Release Solenoid Activation 4° - 8° Carburetor Throttle Actuation 8° - 12°

- 5.5. If the events above occur as they should, hold the ball joint at each end of the accelerator rod with pliers and tighten the accelerator rod jam nut against it.
- 5.6. Again, check that events occur as described in step 5.4.

NOTE

- AFTER THE PEDAL GROUP AND ACCELERATOR ROD ARE ADJUSTED. THE FINAL GOVERNED ENGINE RPM SHOULD BE SET TO 2700 RPM ± 30 RPM.
 - 5.7. Install the electrical box cover.
- · Adjust the Accelerator Rod V-Glide 36-volt vehicles, PowerDrive System 48 and PowerDrive Plus vehicles.

A CAUTION

- ADJUST THE ACCELERATOR ROD/WIPER SWITCH ARM EXACTLY AS STATED IN STEP 5.2 OR THE WIPER SWITCH COULD BECOME DAMAGED AND NOT OPERATE PROPERLY.
 - 5.1. Remove the driver side wiper switch cover.
 - 5.2. Slowly depress the accelerator pedal to the floor and hold it in this position. With the accelerator pedal fully depressed, the wiper switch arm brush should be positioned entirely on the last fixed contact. It is acceptable for the wiper switch arm to come into contact with the wiper switch housing provided there is no excessive pressure against the housing. To check wiper arm pressure against the housing, keep the accelerator pedal fully depressed and disconnect the accelerator rod from the wiper switch ball stud. Then try to reconnect it. If the accelerator pedal must be released in order to reconnect the accelerator rod, then the wiper switch arm is exerting excessive pressure against the housing; proceed to step 5.3. If the accelerator rod can be easily connected, it is correctly adjusted.
 - 5.3. If the accelerator rod is not adjusted correctly, disconnect it from the ball stud at the wiper switch and manually rotate the bell crank until the wiper switch arm brush is positioned entirely on the last fixed contact.
 - 5.4. While holding accelerator rod (17) with pliers, loosen the jam nut (18) and adjust the ball joint (19) sleeve to fit on the wiper switch ball stud, with approximately the same number of threads showing at each end of the rod. Then tighten jam nut (18) against the sleeve (Figure 5-12, Page 5-8).

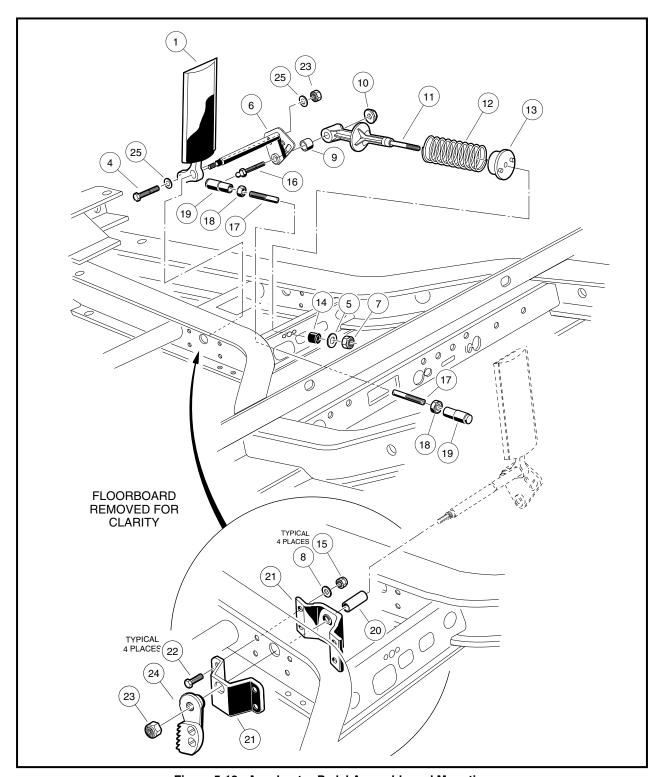


Figure 5-12 Accelerator Pedal Assembly and Mounting

- 5.5. Depress the accelerator pedal several times and then check to be sure that the wiper switch arm brush is positioned entirely on the eighth fixed contact, and that the wiper switch arm is not exerting excessive pressure against the wiper switch housing.
- 5.6. Install the wiper switch cover.

PEDAL GROUP DISASSEMBLY AND ASSEMBLY

Read WARNING on page 5-1 and 5-2.

BRAKE PEDAL REMOVAL

- 1. Make sure key switch is OFF and that the Forward/Reverse handle is in NEUTRAL, then disconnect battery or batteries as instructed in WARNING on pages 5-1 and 5-2.
- 2. Place chocks under the rear wheels and lift the front end of the vehicle with a chain hoist or floor jack. Place jackstands under the front cross tube of the vehicle frame and lower the vehicle onto the jackstands. See following WARNING.

WARNING

- LIFT ONLY ONE END OF A VEHICLE AT A TIME. BEFORE LIFTING, LOCK THE BRAKES AND CHOCK THE WHEELS THAT REMAIN ON THE FLOOR. USE A SUITABLE LIFTING DEVICE (CHAIN HOIST OR HYDRAULIC FLOOR JACK) WITH 1000 LB. (454 KG.) MINIMUM LIFTING CAPACITY. DO NOT USE LIFTING DEVICE TO HOLD VEHICLE IN RAISED POSITION. ALWAYS USE APPROVED JACKSTANDS OF PROPER WEIGHT CAPACITY TO SUPPORT THE VEHICLE.
- 3. Remove the brake pedal assembly.
 - 3.1. Disconnect the rod (13) from the pedal shaft by removing the bolt (14) and nut (15) (Figure 5-14, Page 5-11).
 - 3.2. Remove the nuts (5), flat washers (2), bolts (4), and mounting blocks (23). If the mounting blocks show signs of excessive wear or are damaged, they must be replaced with new ones before installing pedal assembly.
 - 3.3. Remove the nut (12) and brake stop (11) (Figure 5-14, Page 5-11).
 - 3.4. Lift the pedal assembly (8) up through the floorboard (Figure 5-14, Page 5-11).

BRAKE PEDAL INSTALLATION

- 1. Install the brake pedal assembly.
 - 1.1. From the top side of the floorboard, insert the brake pedal weldment assembly (8) (Figure 5-14, Page 5-11) through the opening in the floor as shown (Figure 5-13, Page 5-9), and install the pedal stop (11) (Figure 5-14, Page 5-11) on the weldment.

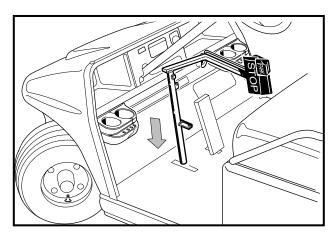


Figure 5-13 Brake Pedal Weldment Through Floor

Brake Pedal Installation, Continued:

- 1.2. Attach the equalizer rod (13) to the brake pedal weldment assembly (8) as shown (Figure 5-14, Page 5-11). Tighten the bolt (14) and nut (15) to 17 ft-lb (23.1 N-m).
- 1.3. Position and attach brake pedal assembly and mounting blocks (23) to vehicle frame as shown. Tighten the bolts and nuts to 50 in-lb (6.5 N-m) (Figure 5-14, Page 5-11). See following NOTE.
- 1.4. Install the brake cables (6) on the equalizer rod (Figure 5-14, Page 5-11).
- 1.5. Tighten the nut (2) on the equalizer rod (1) so that brake pedal free-play is 1/4 inch to 1/2 inch (6 mm to 13 mm) (Figure 5-4, Page 5-3). See following NOTE.

NOTE

- BRAKE PEDAL FREE-PLAY IS THE DISTANCE THE BRAKE PEDAL CAN BE DEPRESSED BEFORE THE BRAKE ACTUATOR ARM MOVES.
- VEHICLES EQUIPPED WITH THE BRAKE EQUALIZER SHOWN IN FIGURE 5-1, PAGE 5-2 SHOULD BE CONFIGURED WITH TWO NUTS AS ILLUSTRATED.
 - 1.6. Tighten the jam nut (3) while holding the adjustment nut (2) in the correct position (Figure 5-4, Page 5-3).

PARK BRAKE REMOVAL

 Make sure the key switch is OFF and that the Forward/Reverse handle is in NEUTRAL, then disconnect the battery or batteries as instructed in WARNING on pages 5-1 and 5-2. See following CAUTION.

A CAUTION

- DISCHARGE CONTROLLER ON POWERDRIVE VEHICLES PER INSTRUCTIONS IN THE WARNING ON PAGE 5-2.
- 2. Place chocks under the rear wheels and lift the front end of the vehicle with a chain hoist or floor jack. Place jackstands under the front cross tube of the vehicle frame and lower the vehicle onto the jackstands. **See following WARNING**.

A WARNING

- LIFT ONLY ONE END OF THE VEHICLE AT A TIME. BEFORE LIFTING, LOCK THE BRAKES AND CHOCK THE WHEELS THAT REMAIN ON THE FLOOR. USE A SUITABLE LIFTING DEVICE (CHAIN HOIST OR HYDRAULIC FLOOR JACK) WITH 1000 LB. (454 KG.) MINIMUM LIFTING CAPACITY. DO NOT USE LIFTING DEVICE TO HOLD VEHICLE IN RAISED POSITION. ALWAYS USE APPROVED JACKSTANDS OF PROPER WEIGHT CAPACITY TO SUPPORT THE VEHICLE.
- 3. Remove the park brake assembly.
 - 3.1. To remove the park brake rod and pawl assembly (16 through 19 and 35), remove the push-on nut (18) and disconnect the ball joint sleeve (20) from the park brake pedal (24). (Figure 5-14, Page 5-11). See following NOTE.

NOTE

• NEW PUSH-ON NUTS (18) AND (27) **(FIGURE 5-15, PAGE 5-12)** MUST BE USED WHEN REASSEMBLING THE PARK BRAKE.

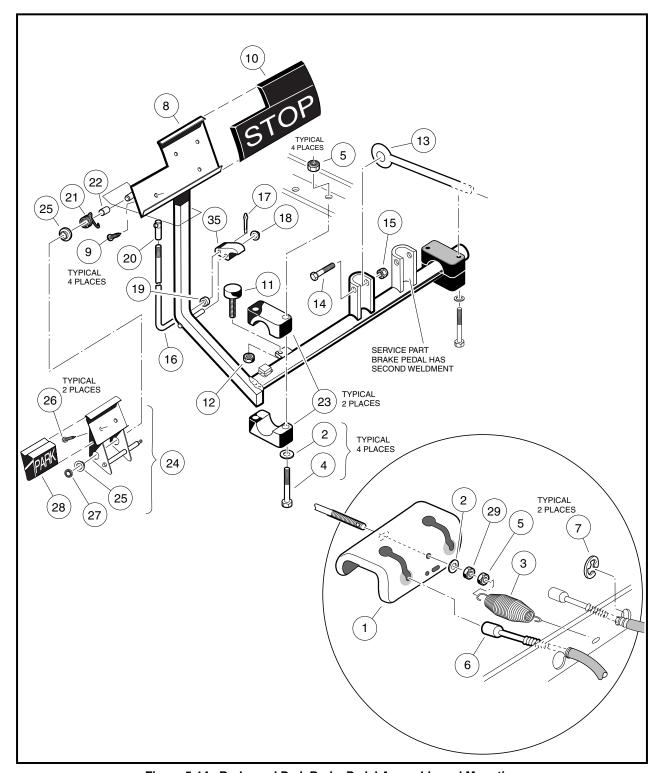
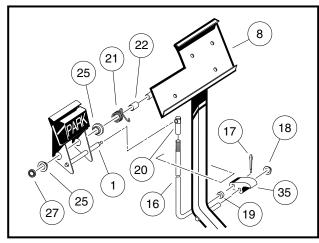


Figure 5-14 Brake and Park Brake Pedal Assembly and Mounting

- 3.2. To remove the park brake pedal (1), remove the push-on retainer nut (27), disconnect the torsion spring (21) (Figure 5-16, Page 5-12) and slide the pedal off of the shaft. See preceding NOTE.
- 3.3. Inspect all parts for wear or damage and replace as necessary.

Hook one



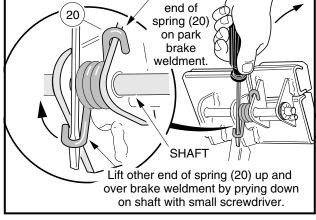


Figure 5-15 Park Brake Assembly

Figure 5-16 Attach Torsion Spring

PARK BRAKE INSTALLATION

- 1. From the bottom side of the floorboard, insert the park brake rod (16) through the brake pedal assembly opening as shown. Then install the park brake pawl (35) onto the shaft on the brake pedal assembly weldment (8) and also the park brake rod (16) into the park brake pawl (Figure 5-15, Page 5-12).
- 2. Install the push nut (18) onto the park brake pawl shaft (Figure 5-15, Page 5-12).
- 3. Install the spacer (22) and torsion spring (21) on the park brake pedal shaft on the brake pedal weldment (Figure 5-15, Page 5-12).
- 4. Install the two bushings (25) in the park brake pedal and position the park brake pedal on the shaft on the brake pedal assembly weldment (Figure 5-15, Page 5-12). Then attach the ends of the torsion spring to the park brake pedal and to the brake pedal weldment as shown (Figure 5-16, Page 5-12).
- 5. Install the push nut (27) on the park brake pedal shaft (Figure 5-15, Page 5-12).
- Connect park brake rod (16) ball joint to ball stud on park brake pedal assembly (Figure 5-15, Page 5-12).
- 7. Adjust park brake ratchet/pawl gap and pawl engagement. See page 5-3.

ACCELERATOR PEDAL REMOVAL

1. Make sure they key switch if OFF and that the Forward and Reverse Switch is in NEUTRAL, then disconnect the batteries as shown. **See following CAUTION.**

A CAUTION

- DISCHARGE CONTROLLER ON POWERDRIVE SYSTEM 48 VEHICLES PER INSTRUCTIONS IN WARNING ON PAGE 5-2.
- Place chocks under the rear wheels and lift the front end of the vehicle with a chain hoist or floor jack. Place jackstands under the front cross tube of the vehicle frame and lower the vehicle onto the jackstands. See following WARNING.

WARNING

- LIFT ONLY ONE END OF THE VEHICLE AT A TIME. BEFORE LIFTING, LOCK THE BRAKES AND CHOCK THE WHEELS THAT REMAIN ON THE FLOOR. USE A SUITABLE LIFTING DEVICE (CHAIN HOIST OR HYDRAULIC FLOOR JACK) WITH 1000 LB. (454 KG.) MINIMUM LIFTING CAPACITY. DO NOT USE LIFTING DEVICE TO HOLD VEHICLE IN RAISED POSITION. ALWAYS USE APPROVED JACKSTANDS OF PROPER WEIGHT CAPACITY TO SUPPORT THE VEHICLE.
- 3. Disconnect the accelerator rod assembly (17, 18, and 19) (Figure 5-12, Page 5-8) at the front and rear ball studs and remove it from the vehicle.
- 4. Remove the nut (23), two washers (25), and bolt (4) securing the accelerator pedal (1) to the pivot rod (6) (Figure 5-12, Page 5-8).
- 5. Remove the nut (10), ball stud (16), and pivot support bearing (9) from the accelerator pivot rod assembly (6) (Figure 5-12, Page 5-8).
- 6. Slide the spring retainer (11) off of the accelerator pivot rod.
- 7. Use a marker to mark the position of the park brake ratchet (24) on the accelerator pivot rod (6) (Figure 5-12, Page 5-8). See following NOTE.

NOTE

- FAILURE TO MARK POSITION OF THE RATCHET COULD CAUSE IT TO BE REINSTALLED. IMPROPERLY, RESULTING IN IMPROPER ADJUSTMENT AND POSSIBLE FAILURE OF THE PARK BRAKE.
- 8. Remove the lock nut (23) from the accelerator pivot shaft (Figure 5-12, Page 5-8).
- 9. Depress the brake pedal slightly and then slide the park brake ratchet (24) (Figure 5-12, Page 5-8) toward the end of the accelerator pivot rod. Rotate the ratchet and remove it from the pivot rod.
- 10. Inspect the accelerator pivot rod supports (21) for wear or damage and replace as necessary. If the pivot rod supports do not require replacement, loosen but do not remove the four bolts (22) and locknuts (15) to make installation easier.
- 11. Pull accelerator pedal (1) out of vehicle from the top side of the floorboard (Figure 5-12, Page 5-8).

ACCELERATOR PEDAL INSTALLATION

- 1. If the accelerator pivot rod supports were replaced, position the supports (21) on the vehicle frame and install the four bolts (22), flat washers (8), and locknuts (15). Tighten the nuts with fingers only at this time.
- 2. Insert the lower end of the accelerator pedal (1) through the floorboard and install the accelerator pivot rod (6) through the uppermost hole in the pedal. Insert the bolt (4) through the lower hole in the pedal and through the pivot rod. Install the two washers (25), and nut (23) on the bolt. Tighten the nut with fingers only at this time (Figure 5-12, Page 5-8).
- 3. Install the plastic spacer (20) on the pivot rod (Figure 5-12, Page 5-8).
- 4. Insert the pivot rod through the pivot rod supports on the vehicle frame.
- 5. Install the ball stud (16) through the pivot rod. Using needle-nose pliers, install the pivot support bearing (9) and the spring retainer (11) onto the ball stud. Secure these parts with the nut (10) (Figure 5-12, Page 5-8). Tighten the nut to 50 in-lb (5.5 N-m).

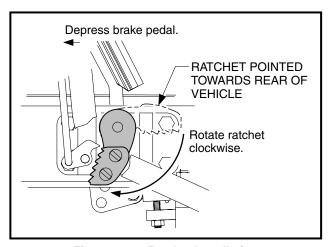


Figure 5-17 Ratchet Installation

- 6. Depress the brake pedal slightly, and with the park brake ratchet oriented so that the tip of the ratchet is pointed toward the rear of vehicle, slide the ratchet onto the pivot rod (do not slide the ratchet onto the pivot rod splines). Release the brake pedal and allow the ratchet to rotate until its tip is pointed downward (Figure 5-17, Page 5-14). The ratchet should now rotate freely on the rod.
- 7. Rotate ratchet clockwise until it touches the park brake pawl, then slide the ratchet onto the splines of the pivot rod (it may be necessary to push the pivot rod toward the driver side of the vehicle to make the splines accessible). The ratchet may have to be rotated counterclockwise slightly to align the splines.
- 8. Move the pivot rod back toward the driver side of the vehicle and line up the scribed match marks on the pivot rod and ratchet. Rotate the pivot rod back and forth slightly to align the splines and slide the ratchet onto the splines.
- 9. Install nylon lock nut (23) (Figure 5-12, Page 5-8) on pivot rod. Tighten the nut to 18 ft-lb (24.5 N-m).
- 10. Install the accelerator rod assembly (17, 18, and 19) (Figure 5-12, Page 5-8).
- 11. Adjust the accelerator pedal height. See following NOTE.

NOTE

- THE PROCEDURE FOR ADJUSTING THE ACCELERATOR PEDAL HEIGHT IS ON PAGE 5-5.
- Adjust the accelerator rod. See following NOTE.

NOTE

 THE PROCEDURE FOR ADJUSTING THE ACCELERATOR ROD ON GASOLINE VEHICLES IS ON PAGE 5-6. ACCELERATOR ROD ADJUSTMENT FOR V-GLIDE 36-VOLT VEHICLES, AND FOR POWERDRIVE SYSTEM 48 AND POWERDRIVE PLUS VEHICLES IS ON PAGE 5-7.

SECTION 6-WHEEL BRAKE ASSEMBLIES

A WARNING

- ONLY TRAINED TECHNICIANS SHOULD REPAIR OR SERVICE THIS VEHICLE. ANYONE DOING EVEN SIMPLE REPAIRS OR SERVICE SHOULD HAVE KNOWLEDGE AND EXPERIENCE IN ELECTRICAL AND MECHANICAL REPAIR.
- FOLLOW ALL PROCEDURES EXACTLY AS STATED IN THIS MANUAL, AND HEED ALL DANGER, WARNING, AND CAUTION STATEMENTS LISTED IN THIS MANUAL, AS WELL AS THOSE AFFIXED TO THE VEHICLE.
- WEAR SAFETY GLASSES OR APPROVED EYE PROTECTION WHILE SERVICING VEHICLE. WEAR A FULL FACE SHIELD WHEN WORKING WITH BATTERIES.
- TURN KEY SWITCH **OFF**, REMOVE THE KEY, PLACE FORWARD/REVERSE HANDLE IN THE **NEUTRAL** POSITION, CHOCK THE WHEELS, AND DISCONNECT THE BATTERY(IES) PRIOR TO SERVICING THE VEHICLE.
- SOME AFTERMARKET BRAKE SHOES CONTAIN ASBESTOS FIBER, AND ASBESTOS DUST IS CREATED WHEN THESE BRAKE MECHANISMS ARE HANDLED. WEAR APPROVED EYE AND RESPIRATORY PROTECTION WHEN DISASSEMBLING AND CLEANING BRAKE MECHANISMS. INHALATION OF ASBESTOS COULD RESULT IN SEVERE PERSONAL INJURY OR DEATH. DO NOT USE COMPRESSED AIR OR AEROSOL SPRAYS TO CLEAN THE BRAKE MECHANISM. CLEAN BRAKE MECHANISM USING THE NEGATIVE PRESSURE ENCLOSURE/HEPA VACUUM SYSTEM OR LOW PRESSURE/WET CLEANING METHOD PER OSHA/29 CFR 1910.1001.
- MOVING PARTS! DO NOT ATTEMPT TO SERVICE THE VEHICLE WHILE IT IS RUNNING.
- USE INSULATED TOOLS WHEN WORKING NEAR BATTERIES OR ELECTRICAL CONNECTIONS. USE EXTREME CAUTION TO AVOID SHORTING OF COMPONENTS OR WIRING.
- LIFT ONLY ONE END OF THE VEHICLE AT A TIME. BEFORE LIFTING, LOCK THE BRAKES AND CHOCK THE WHEELS THAT REMAIN ON THE FLOOR. USE A SUITABLE LIFTING DEVICE (CHAIN HOIST OR HYDRAULIC FLOOR JACK) WITH 1000 LB. (454 KG.) MINIMUM LIFTING CAPACITY. DO NOT USE LIFTING DEVICE TO HOLD VEHICLE IN RAISED POSITION. ALWAYS USE APPROVED JACKSTANDS OF PROPER WEIGHT CAPACITY TO SUPPORT THE VEHICLE
- DO NOT WEAR LOOSE CLOTHING. REMOVE JEWELRY SUCH AS RINGS, WATCHES, CHAINS, ETC. BEFORE SERVICING VEHICLE.

GASOLINE VEHICLES ONLY:

- TO AVOID UNINTENTIONALLY STARTING THE VEHICLE:
 - DISCONNECT BATTERY CABLES, NEGATIVE (-) FIRST (SECTION 1, FIGURE 1-1).
 - DISCONNECT THE SPARK PLUG WIRE FROM THE SPARK PLUG.
- FRAME GROUND DO NOT ALLOW TOOLS OR OTHER METAL OBJECTS TO CONTACT FRAME WHEN DISCONNECTING BATTERY CABLES OR OTHER ELECTRIC WIRING. NEVER ALLOW A POSITIVE WIRE TO TOUCH THE VEHICLE FRAME, ENGINE, OR OTHER METAL COMPONENT.

ELECTRIC VEHICLES ONLY:

- TO AVOID UNINTENTIONALLY STARTING THE VEHICLE, DISCONNECT BATTERIES AS SHOWN (SECTION 1, FIGURE 1-2 OR 1-3).
- ON POWERDRIVE PLUS VEHICLES, PLACE THE TOW/RUN SWITCH IN THE **TOW** POSITION **BEFORE** DISCONNECTING BATTERIES.
- ON POWERDRIVE SYSTEM 48 VEHICLES, DISCHARGE THE CONTROLLER AS FOLLOWS **AFTER** DISCONNECTING BATTERIES:

WARNING CONTINUED ON NEXT PAGE ...

A WARNING

- TURN THE KEY SWITCH TO **ON** AND PLACE THE FORWARD/REVERSE HANDLE IN THE **REVERSE** POSITION.
- SLOWLY DEPRESS THE ACCELERATOR PEDAL AND KEEP IT DEPRESSED UNTIL THE REVERSE WARNING BUZZER CAN NO LONGER BE HEARD. WHEN THE BUZZER STOPS SOUNDING, THE CONTROLLER IS DISCHARGED.

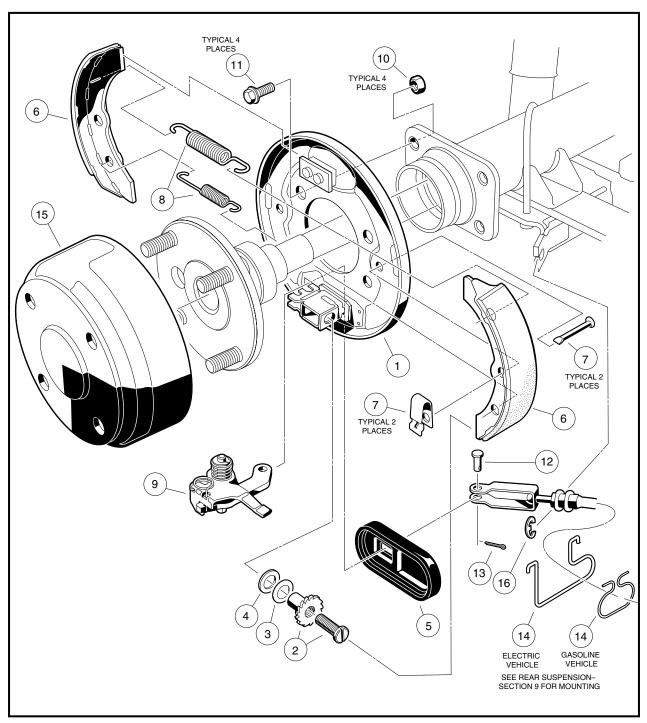


Figure 6-1 Self-adjusting Wheel Brake Assembly

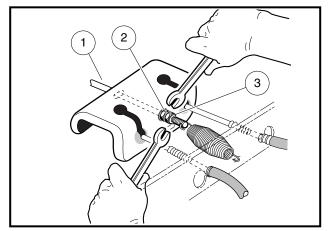
GENERAL INFORMATION

DS Golf Cars are equipped with self-adjusting, mechanically-expanding shoe drum brakes on each rear wheel.

BRAKE SHOE REMOVAL

Read WARNING on pages 6-1 and 6-2.

1. Place chocks at the front wheels. Loosen, but do not remove, lug nuts on rear wheels and lift the rear of the vehicle with a chain hoist or floor jack. Place jackstands under the axle tubes to support the vehicle.



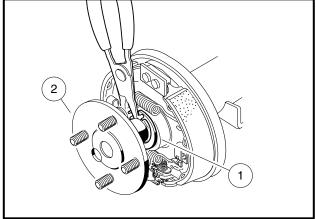


Figure 6-2 Loosen Equalizer Retaining Nuts

Figure 6-3 Remove Axle Retaining Ring

- 2. Loosen the equalizer retaining nuts (2 and 3) on the equalizer rod (1) to loosen the brake cable (Figure 6-2, Page 6-3).
- 3. Remove the rear wheels and then the brake drums. If the brake drums were easily removed, proceed to step 5.

NOTE

- WHEN SERVICING VEHICLES WITH SEVERELY WORN BRAKE SHOES AND WHEN THE DRUMS CANNOT BE REMOVED BY NORMAL METHODS, PROCEED TO STEP 4 TO MINIMIZE DAMAGE TO THE BRAKE CLUSTER AND BRAKE COMPONENTS.
- 4. Remove brake drums and badly worn brake shoes.
 - 4.1. On the back of each brake cluster assembly, locate the heads of two brake shoe retainer pins. It may be necessary to remove sealant material around the head of each pin.
 - 4.2. Insert a 1/2 inch x 5/8 inch cold chisel under the head of each pin and shear them off as illustrated (Figure 6-4, Page 6-4). This will release the shoes from the backing plate, allowing them to pivot away from the inside of the brake drum, which should then allow the brake drum to be pulled free. After completing step 5, skip step 6.
- 5. Remove the axle.
 - 5.1. Using 90° snap ring pliers (Club Car Part No. 1012560), remove the axle retaining ring (1) (Figure 6-3, Page 6-3).
 - 5.2. Pull the axle shaft (2) from the axle tube (Figure 6-3, Page 6-3).

Brake Shoe Removal, Continued:

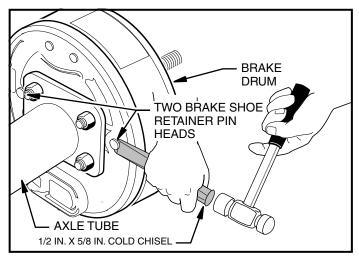
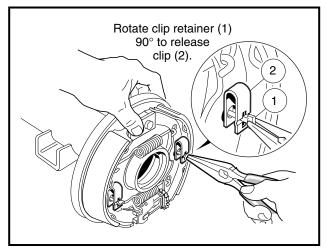
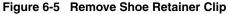


Figure 6-4 Shoe Retainer Pins





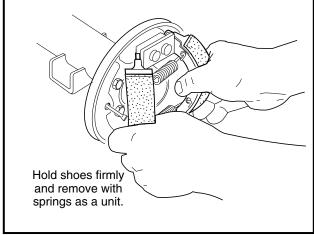


Figure 6-6 Remove Brake Shoes

6. Using needle nose pliers, turn the clip retainer (1) 90° to remove the shoe retainer clip (2) **(Figure 6-5, Page 6-4)**.

A CAUTION

- THE BRAKE SHOES ARE UNDER PRESSURE AND CAN RELEASE SUDDENLY WHEN BRAKE SHOE RETAINERS ARE REMOVED.
- 7. Grasp both brake shoes and pull them, together with the springs, out of the brake assembly as shown (Figure 6-6, Page 6-4).
- 8. Remove adjuster wheel (1) with two washers (2 and 3) from the backing plate (Figure 6-7, Page 6-5).

BRAKE ASSEMBLY CLEANING

Read WARNING on pages 6-1 and 6-2.

- 1. Carefully clean the brake backing plate and all of its mechanical components.
- 2. Remove the rubber boot from backing plate and wipe with a clean damp cloth.
- 3. Lubricate the slide (1) and slide plate (2) with dry moly lubricant (Club Car Part No. 1012151) on both sides of the backing plate. After lubricating, work the slide back and forth to ensure that it slides smoothly and easily (Figure 6-8, Page 6-5). Reinstall rubber boot onto backing plate.

WARNING

- APPLY GREASE CAREFULLY WHEN PERFORMING THE FOLLOWING STEPS. DO NOT ALLOW
 ANY GREASE TO GET ONTO THE FRICTION SURFACES OF THE BRAKE SHOE PADS.
 FAILURE TO HEED THIS WARNING COULD CAUSE DIMINISHED BRAKE PERFORMANCE,
 POSSIBLY RESULTING IN PROPERTY DAMAGE OR SEVERE PERSONAL INJURY.
- Use a small brush to carefully apply a liberal amount of white lithium NLGI #2 grease (Dow Corning[®] BR2-Plus or equivalent) on each of the six raised bosses on the brake backing plate (Figure 6-9, Page 6-5). See preceding WARNING.

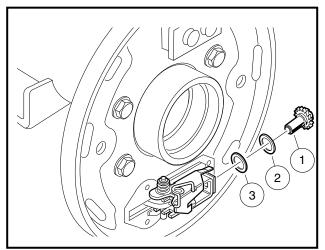


Figure 6-7 Remove Adjuster Wheel

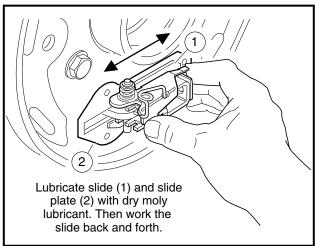


Figure 6-8 Lubricate Slide and Slide Plate

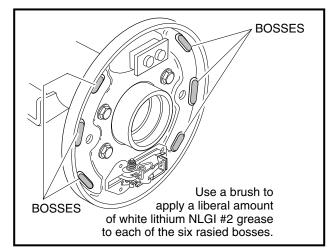


Figure 6-9 Apply Grease On Bosses

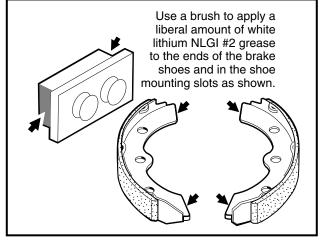


Figure 6-10 Apply Grease To Brake Shoes and Slots

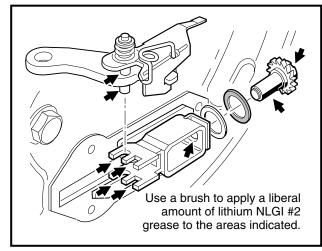
5. Use a small brush to carefully apply a liberal amount of white lithium NLGI #2 grease (Dow Corning[®] BR2-Plus or equivalent) to each end of both brake shoes and into the slots in the brake shoe mounting block as shown (Figure 6-10, Page 6-5). See preceding WARNING.

WHEEL BRAKE ASSEMBLIES Brake Shoe Installation

Brake Assembly Cleaning, Continued:

6. Use a small brush to carefully apply a liberal amount of white lithium NLGI #2 grease (Dow Corning[®] BR2-Plus or equivalent) to the brake adjuster assembly, adjuster wheel shoe slots, and the shaft of the adjuster wheel as shown (Figure 6-11, Page 6-6). See preceding WARNING.

7. Install the adjuster wheel (1) and two washers (2 and 3) into the adjuster assembly (Figure 6-7, Page 6-5).



Turn adjusting wheel so that the shoe slot is vertical.

Figure 6-11 Apply Grease To Brake Adjuster

Figure 6-12 Install Adjuster Wheel, Trailing Shoe

BRAKE SHOE INSTALLATION

Read WARNING on pages 6-1 and 6-2.

 Turn the adjusting wheel screw so that the shoe slot is vertical, then position the trailing shoe in the slots in the shoe mounting block and adjuster assembly (Figure 6-12, Page 6-6). See following NOTE.

NOTE

- THE TRAILING SHOE HAS 17T STAMPED INTO THE TIP OF THE SHOE FLANGE (FIGURE 6-12, PAGE 6-6). THE LEADING SHOE IS STAMPED 17L. WHEN INSTALLING THE SHOES, THE STAMPING ON BOTH SHOES SHOULD BE ORIENTED TO THE TOP OF THE BRAKE ASSEMBLY. WHEN INSTALLING THE SHOES ON THE PASSENGER SIDE OF THE VEHICLE, THE SIDE OF THE TRAILING SHOE FLANGE MARKED 17T SHOULD BE FACING OUT AND BE VISIBLE. ON THE DRIVER SIDE, THE 17L ON THE LEADING SHOE SHOULD BE FACING OUT AND BE VISIBLE.
- WHEN INSTALLED ON THE BACKING PLATE, THE LEADING SHOE (STAMPED 17L) IS ALWAYS ORIENTED TOWARD THE REAR OF THE VEHICLE.
- 2. Install the shoe retainer clip, using pliers to compress the clip while turning the clip retaining tab into position (Figure 6-13, Page 6-7).
- 3. Attach the springs onto the trailing shoe already installed. Then hold the leading shoe next to the trailing shoe, correctly oriented, and attach the springs to it (Figure 6-14, Page 6-7).
- 4. While maintaining spring attachment on both shoes, position tips of leading shoe in the mounting slots and then push shoe into place. Hold shoe in position and install retaining clip (Figure 6-15, Page 6-7).

5. After the shoes are installed, move them together up and down and side to side to make sure that they will easily slide approximately 1/4 to 3/8 inch (6.3 to 9.5 mm) without binding. Make sure that the shoes are positioned vertically so that the tips of the shoes are positioned flush at the top with the top surfaces of the wedge shapes on the shoe mounting blocks as shown (Figure 6-16, Page 6-7).

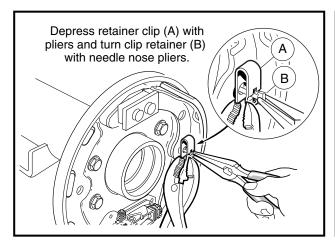


Figure 6-13 Install Trailing Shoe Retainer Clip

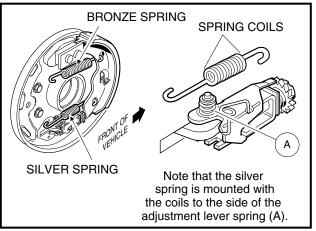


Figure 6-14 Attach Springs

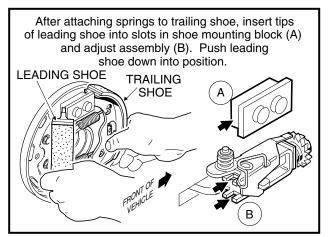


Figure 6-15 Install Leading Shoe

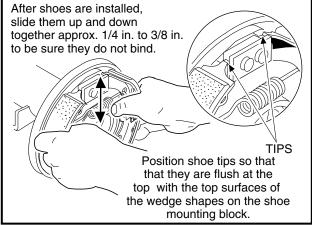


Figure 6-16 Check Shoe Positions

- Place a flatblade screwdriver under the adjusting arm and raise the arm off of the adjusting wheel.
 While holding the arm up, turn the wheel upward until it stops (Figure 6-17, Page 6-8). Remove the screwdriver.
- 7. Install the axle shaft (2) into the axle tube and install the retaining ring (1) (Figure 6-3, Page 6-3). See following WARNING and CAUTION.

WARNING

• BE SURE RETAINING RING IS PROPERLY SEATED IN GROOVE. IF RING IS NOT PROPERLY INSTALLED, THE AXLE ASSEMBLY WILL SEPARATE FROM THE TRANSAXLE AND DAMAGE THE AXLE ASSEMBLY AND OTHER COMPONENTS. LOSS OF CONTROL OF THE VEHICLE COULD RESULT IN SEVERE PERSONAL INJURY OR DEATH.

WHEEL BRAKE ASSEMBLIES Brake Adjustment

Brake Shoe Installation, Continued:

A CAUTION

 BEFORE INSTALLING AXLE SHAFT, CLEAN ANY RESIDUAL OIL FROM THE EXPOSED END OF THE AXLE TUBE AND FROM THE OIL SEAL AREA.

8. Install the brake drum, and make sure that it is properly seated. See following NOTE.

NOTE

- IF DRUM INSTALLATION IS DIFFICULT, THE BRAKE SHOES MAY NEED TO BE ADJUSTED VERTICALLY IN THE MOUNTING SLOTS.
- 9. After the drum is installed, make sure the axle and drum turn freely and then install the wheel. **See** Wheel Installation, page 8-2.

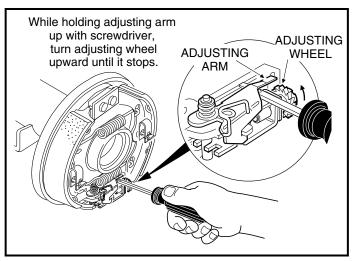


Figure 6-17 Set Adjusting Wheel

BRAKE ADJUSTMENT

Read WARNING on pages 6-1 and 6-2.

- 1. When cleaning or repair on both wheels is complete, and with the brake cable still loose, lower the vehicle to the floor.
- 2. Depress and release the brake pedal repeatedly until an audible clicking can no longer be heard.
- 3. Adjust brake pedal free play. See Pedal Group Adjustment, Page 5-2.

BRAKE CLUSTER REMOVAL AND INSTALLATION

Read WARNING on pages 6-1 and 6-2.

Brake Cluster Removal

 Place chocks at the front wheels and loosen the lug nuts on the rear wheels. Lift the rear of the vehicle with a chain hoist or floor jack. Place jackstands under the axle tubes to support the vehicle. See WARNING on page 6-1.

- 2. Loosen the equalizer retaining nuts (2 and 3) on the equalizer rod (1) to loosen the brake cable (Figure 6-2, Page 6-3).
- 3. Remove lug nuts and rear wheels and then the brake drums.

NOTE

- WHEN SERVICING VEHICLES WITH SELF-ADJUSTING BRAKES WITH BADLY WORN BRAKE SHOES AND WHEN THE DRUMS CANNOT BE REMOVED BY NORMAL METHODS, PERFORM STEP 4 OF "BRAKE SHOE REMOVAL" ON PAGE 6-3 AND CONTINUE WITH THIS PROCEDURE.
- 4. Remove the axle.
 - 4.1. Using 90° snap ring pliers (Club Car Part No. 1012560), remove the axle retaining ring (1) (Figure 6-3, Page 6-3).
 - 4.2. Pull the axle shaft (2) from the axle tube (Figure 6-3, Page 6-3).
- 5. Remove cotter pin (13) and clevis pin (12) from brake cable (Figure 6-1, Page 6-2).
- 6. Remove four bolts (11) and lock nuts (10) that mount the brake assembly to the transaxle (Figure 6-1, Page 6-2).
- 7. Remove brake assembly from transaxle.

Brake Cluster Installation

1. Install in reverse order of disassembly. Use **new** cotter pins when installing brake cables.

A CAUTION

- BEFORE INSTALLING AXLE SHAFT, CLEAN ANY RESIDUAL OIL FROM THE EXPOSED END OF THE AXLE TUBE AND FROM THE OIL SEAL AREA.
- 2. Be sure bolts (11) (Club Car Part No. 1014153) and new lock nuts (10) (Club Car Part No. 1013924) are used to mount the brake assembly (Figure 6-1, Page 6-2).
- 3. Torque bolts to 30 ft-lb (40.6 N-m).

WARNING

- BE SURE RETAINING RING IS PROPERLY SEATED IN GROOVE. IF RING IS NOT PROPERLY INSTALLED, THE AXLE ASSEMBLY WILL SEPARATE FROM THE TRANSAXLE AND DAMAGE THE AXLE ASSEMBLY AND OTHER COMPONENTS. LOSS OF CONTROL OF THE VEHICLE COULD RESULT IN SEVERE PERSONAL INJURY OR DEATH.
- 4. Tighten lug nuts on rear wheels, using crisscross pattern, to 55 ft-lb (74.6 N-m). See Wheel Installation, page 8-2.
- 5. Adjust the brakes. See Brake Adjustment, Page 3-8 and Pedal Group Adjustment, Page 5-2.

BRAKE CABLE REMOVAL AND INSTALLATION

Read WARNING on pages 6-1 and 6-2.

Brake Cable Removal

- 1. Place chocks at the front wheels.
- 2. Release the park brake if latched and loosen equalizer retaining nuts (1) on equalizer rod (2) to loosen the brake cables (3) (**Figure 6-18**, **Page 6-10**).
- 3. Rotate the brake cable upward and pull cable end through hole in top of equalizer (4).

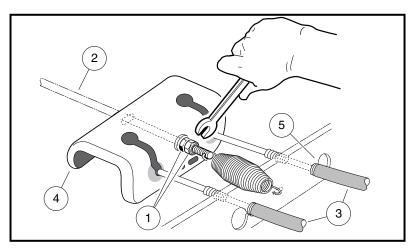


Figure 6-18 Loosen Brake Cables

- 4. Remove E-clip from cable at vehicle frame (5) (Figure 6-18, Page 6-10). Remove cable from frame.
- 5. Remove cotter pin (1) and the clevis pin (2) from the brake lever on each wheel and pull the clevis (3) away from the lever. (Figure 6-19, Page 6-10).
- 6. Remove E-clip (4) from cable at the cable support bracket (5). Remove cable from bracket.

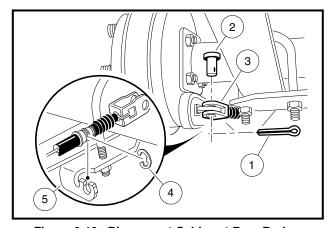


Figure 6-19 Disconnect Cables at Rear Brakes

7. Note routing of cable through hanger for installation of new cable. Pull cable from vehicle.

Brake Cable Installation

- 1. Place the end of the new cable into the equalizer (4) **(Figure 6-18, Page 6-10)**. Secure the cable to the vehicle frame with **new** E-clip. Route cable through hanger in the same manner as before.
- 2. At the rear wheel brake, connect the cable to the brake actuator arm using **new** clevis pin (2) and **new** cotter pin (1) (**Figure 6-19**, **Page 6-10**).
- 3. Place the cable in the cable support bracket (5) and secure with **new** E-clip (3).
- 4. Adjust the brakes. See Brake Adjustment, Page 6-8 and Pedal Group Adjustment, Page 5-2.

SECTION 7-STEERING AND FRONT SUSPENSION

GENERAL INFORMATION - STEERING

Steering is controlled through a rack and pinion steering assembly that is connected by a steering column to a steering wheel.

No manual adjustment to the rack and pinion gear assembly is required. A spring loaded self-adjusting mechanism is incorporated into the assembly.

WARNING

- WEAR SAFETY GLASSES OR APPROVED EYE PROTECTION WHILE SERVICING VEHICLE. WEAR A FULL FACE SHIELD WHEN WORKING WITH BATTERIES.
- MOVING PARTS! DO NOT ATTEMPT TO SERVICE THE VEHICLE WHILE IT IS RUNNING.
- USE INSULATED TOOLS WHEN WORKING NEAR BATTERIES OR ELECTRICAL CONNECTIONS. USE EXTREME CAUTION TO AVOID SHORTING OF COMPONENTS OR WIRING.
- LIFT ONLY ONE END OF THE VEHICLE AT A TIME. BEFORE LIFTING, LOCK THE BRAKES AND CHOCK THE WHEELS THAT REMAIN ON THE FLOOR. USE A SUITABLE LIFTING DEVICE (CHAIN HOIST OR HYDRAULIC FLOOR JACK) WITH 1000 LB. (454 KG.) MINIMUM LIFTING CAPACITY. DO NOT USE LIFTING DEVICE TO HOLD VEHICLE IN RAISED POSITION. ALWAYS USE APPROVED JACKSTANDS OF PROPER WEIGHT CAPACITY TO SUPPORT THE VEHICLE.
- TURN KEY SWITCH TO **OFF**, PLACE FORWARD/REVERSE HANDLE IN THE **NEUTRAL** POSITION, REMOVE KEY, AND DISCONNECT BATTERY(IES) BEFORE SERVICING THE VEHICLE.

GASOLINE VEHICLES ONLY:

- TO AVOID UNINTENTIONALLY STARTING THE VEHICLE:
 - DISCONNECT BATTERY CABLES, NEGATIVE (-) FIRST (SECTION 1, FIGURE 1-1).
 - DISCONNECT THE SPARK PLUG WIRE FROM THE SPARK PLUG.
- FRAME GROUND DO NOT ALLOW UNINSULATED METAL OBJECTS TO CONTACT FRAME WHEN DISCONNECTING BATTERY CABLES OR OTHER ELECTRICAL WIRING. NEVER ALLOW A POSITIVE WIRE TO TOUCH THE VEHICLE FRAME, ENGINE, OR OTHER METAL COMPONENT.

ELECTRIC VEHICLES ONLY:

- TO AVOID UNINTENTIONALLY STARTING THE VEHICLE, DISCONNECT BATTERIES AS SHOWN (SECTION 1, FIGURE 1-2 OR 1-3).
- ON POWERDRIVE PLUS VEHICLES, PLACE TOW SWITCH IN THE **TOW** POSITION *BEFORE* DISCONNECTING BATTERIES.
- ON POWERDRIVE SYSTEM 48 VEHICLES, DISCHARGE THE CONTROLLER AS FOLLOWS **AFTER** DISCONNECTING THE BATTERIES:
 - TURN THE KEY SWITCH TO **ON** AND PLACE THE FORWARD/REVERSE HANDLE IN THE **REVERSE** POSITION.
 - SLOWLY DEPRESS THE ACCELERATOR PEDAL AND KEEP IT DEPRESSED UNTIL THE REVERSE WARNING BUZZER CAN NO LONGER BE HEARD. WHEN THE BUZZER STOPS SOUNDING, THE CONTROLLER IS DISCHARGED.

STEERING WHEEL

Read WARNING on page 7-1.

STEERING WHEEL REMOVAL

- 1. Remove the two mounting screws (32) and plate (27) (Figure 7-3, Page 7-3).
- 2. Match mark the steering wheel (25) and steering column shaft (20) so when the steering wheel is removed it can be placed back in exactly the same position on steering column shaft (Figure 7-3, Page 7-3)
- 3. Loosen the steering wheel nut (26) and back it off approximately 1/4 inch (6 mm). Do not remove the nut (Figure 7-3, Page 7-3).
- 4. Use the steering wheel puller (Club Car Part Number 102061201) to remove steering wheel.
 - 4.1. Place the puller anvil (4) through the top opening of the steering wheel (Figure 7-1, Page 7-2).
 - 4.2. Insert the anvil feet through the two slots in the base plate (marked "B") (5) as shown (Figure 7-1, Page 7-2).
 - 4.3. Rotate the anvil screw (6) clockwise until the base plate contacts the bottom of the steering wheel where it attaches to the steering column (Figure 7-2, Page 7-2).
 - 4.4. Using a 1/2 inch drive air impact wrench, tighten the anvil screw (6) until the steering wheel breaks free from the steering shaft.
 - 4.5. Remove the steering wheel puller.
 - 4.6. Remove the steering wheel nut (26) and the steering wheel from the steering column (21) (Figure 7-3, Page 7-3).

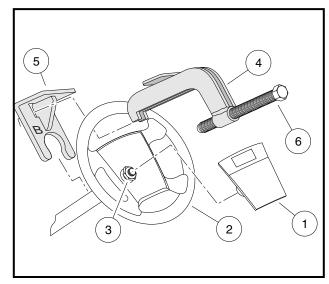


Figure 7-1 Steering Wheel Puller

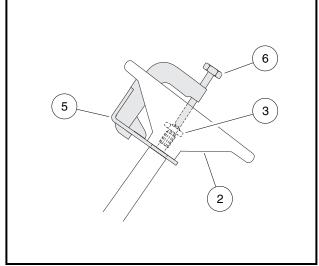


Figure 7-2 Steering Wheel Puller

STEERING WHEEL INSTALLATION

NOTE

 TO MINIMIZE CORROSION AND MAKE FUTURE REMOVAL OF THE STEERING WHEEL EASIER, APPLY A SMALL AMOUNT OF OIL OR ANTI-SEIZE COMPOUND TO STEERING SHAFT SPLINES AND TAPER BEFORE INSTALLING THE STEERING WHEEL.

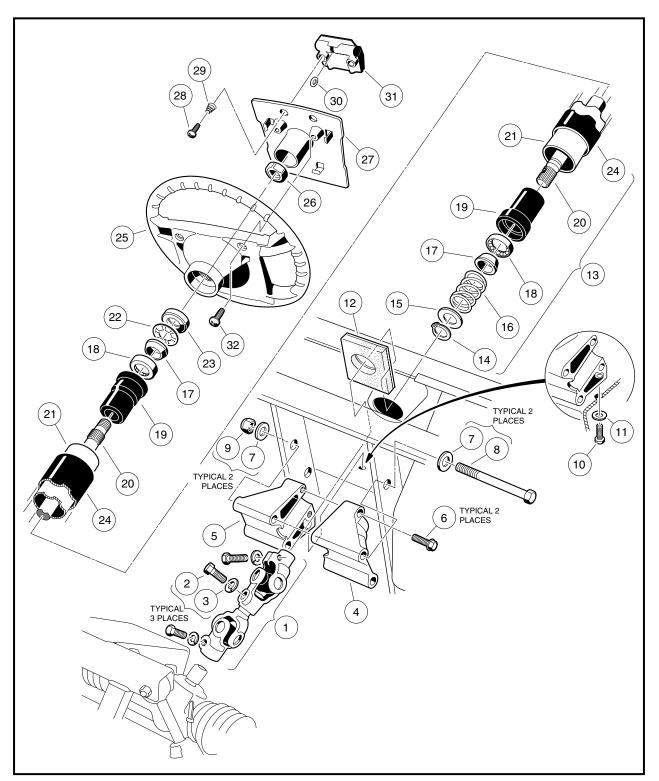


Figure 7-3 Steering Column Assembly and Installation

- 1. Install the steering wheel (25) on the splines of the steering shaft (20), making sure to align the match marks placed on the wheel and steering column in Step 2 above (Figure 7-3, Page 7-3).
- 2. Install the steering wheel nut (26) and tighten it to 14 ft-lb (19 N-m) minimum (Figure 7-3, Page 7-3).
- 3. Install the scorecard plate (27) and scorecard plate mounting screws (32) (Figure 7-3, Page 7-3).

STEERING COLUMN

Read WARNING on page 7-1.

STEERING COLUMN REMOVAL

- 1. Remove the steering wheel as instructed above.
- 2. Remove the front body as instructed in Section 4, Body and Trim.
- 3. Remove the center dash panel (Figure 7-4, Page 7-4).
 - 3.1. Remove the plastic cap covering the screw on each side of the center dash.
 - 3.2. Loosen (but do not remove) the screw on each side of the center dash panel.
 - 3.3. Insert screwdriver at the top center of the dash between dash and cowl brace. Gently pry center dash out slightly from under edge of cowl brace.

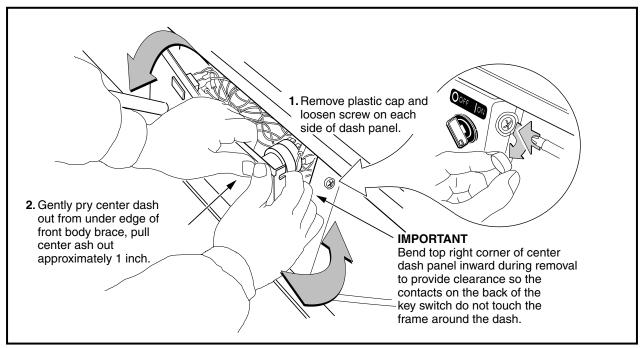


Figure 7-4 Dash Removal

3.4. Pull center dash out approximately 1 inch from the frame and then bend the top right corner inward while pulling the top of the panel out and down.

NOTE

- BENDING THE TOP RIGHT CORNER OF THE CENTER DASH INWARD DURING REMOVAL WILL PREVENT THE CONTACTS ON THE BACK OF THE KEY SWITCH FROM TOUCHING THE METAL FRAME AROUND THE DASH.
 - 3.5. Disconnect the wires from the electrical components mounted on the dash panel. Do not allow wires to touch.
 - 3.6. Slide center dash panel up the steering column.
- 4. Remove the driver side dash pocket.

- 4.1. Remove cup holder hardware and cup holder.
- 4.2. Remove the flange lock screw from the top of the dash pocket.
- 4.3. Drill out the two pop rivets holding the dash pocket in place.
- 4.4. Slide dash pocket out of vehicle.
- 5. Remove the upper bolt (2) and lock washer (3) from the universal joint (Figure 7-3, Page 7-3).
- 6. Remove the nuts (9), bolts (8 and 10), and washers (7 and 11) from the steering column mount (4 and 5) (Figure 7-3, Page 7-3).
- 7. Remove the steering column from the vehicle.

STEERING COLUMN DISASSEMBLY

- 1. Remove screws (6) and mount (4 and 5) from the steering column (Figure 7-3, Page 7-3).
- While supporting the steering shaft (20), remove snap ring (14) from shaft (Figure 7-3, Page 7-3).

NOTE

- DO NOT ALLOW THE STEERING SHAFT TO SLIDE OUT OF THE STEERING TUBE WHILE REMOVING THE SNAP RING.
- Remove the washer (15), spring (16), and wedge (17) (Figure 7-3, Page 7-3).
- 4. Turn the steering column over and insert a flat blade screwdriver between the seal (23) and the shaft. Pry the seal out of the bearing seat (19) (Figure 7-3, Page 7-3).

NOTE

- USE A NEW SEAL AND RETAINING RINGS FOR REASSEMBLY.
- 5. Slide the shaft out of the tube to expose the retaining ring (22). Use pliers to twist the retaining ring until it breaks off, then remove the wedge (17) (Figure 7-3, Page 7-3).
- 6. Remove the shaft from the bottom of the tube.
- 7. Use the steering shaft to push the bearing seat (19) out from the opposite end of the steering tube (21) (Figure 7-3, Page 7-3).
- 8. Insert a flat blade screwdriver between the bottom of the outer race of the bearing and the bottom lip of the bearing seat (19) and remove the bearing (18) (Figure 7-3, Page 7-3).

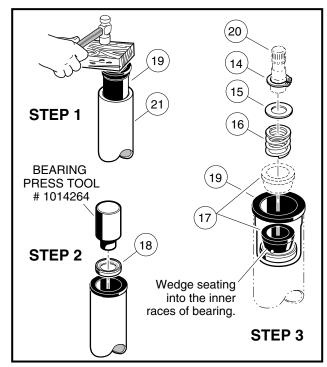
CAUTION

DO NOT DAMAGE THE BEARING OR BEARING SEAT WHILE REMOVING THE BEARING

STEERING COLUMN ASSEMBLY

- 1. Insert the bearing seat (19) into the steering tube (21). Place a block of wood on the bearing seat and tap lightly on the block until the bearing seat is fully seated in the steering tube (Figure 7-5, Page 7-6).
- 2. Press the bearing (18) all the way into the bearing seat (19) using a steering column bearing press tool (Club Car Part No. 1014264) or a metal tube approximately 6 inch (15 cm) long with a maximum outer diameter of 1-3/16 inch (3.3 cm) and a minimum inside diameter of 7/8 inch (2.2 cm). Be sure the bearing is installed in the bearing seat as shown (Figure 7-5, Page 7-6) so that the wedge (17) will ride against the inner race of the bearing.

Steering Column Assembly, Continued:



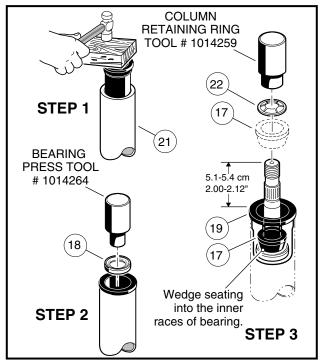


Figure 7-5 Bottom End of Steering Column

Figure 7-6 Top End of Steering Column

- 3. Install the wedge (17), spring (16), washer (15), and snap ring (14) onto the bottom end of the steering shaft (20) (Figure 7-5, Page 7-6).
- 4. Insert the shaft from the bottom of the steering tube.
- 5. Turn the assembly over and place the shaft on a bench. Install the wedge (17) and retaining ring (22) onto the top of the shaft. Be sure that the prongs on the retaining ring face up and away from the wedge. Use a steering column retaining ring tool (Club Car Part No. 1014259) to seat the retaining ring to the proper depth. If you do not have the recommended tool, use the same tube as was used in Step 2 to press the retaining ring onto the top of the shaft. The retaining ring should be pressed onto the shaft until 2 to 2.12 inch (5.1-5.4 centimeters) of the shaft extends from the top of the bearing seat in the steering tube (Figure 7-6, Page 7-6).
- 6. Press the seal (23) into the bearing seat (19) until it is flush with the end of the seat (Figure 7-3, Page 7-3). When pressing the seal into the seat, set the steering tube on a bench so that all the pressure is exerted on the steering tube and not on the steering shaft.

STEERING COLUMN INSTALLATION

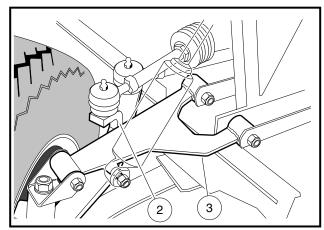
- 1. Reinstall mount (4 and 5) onto end of steering column. Tighten bolts (6) to 22 ft-lb (30 N-m) (Figure 7-3, Page 7-3).
- 2. For ease of assembly and to prevent corrosion, apply a light coat of anti-seize and lubricating compound to both splined ends of the steering shaft.
- 3. Position the steering column assembly in the vehicle while inserting the steering column shaft into the upper universal joint. The flat portion of the steering shaft spline must be aligned with the bolt hole in the universal joint before sliding the spline into the universal joint. While holding the steering column in place, attach it to the frame using bolts (8), washers (7) and nuts (9) (Figure 7-3, Page 7-3). Thread the nuts onto the bolts but do not tighten them.
- 4. Reinstall washer (11) and screw (10). Torque to 22 ft-lb (30 N-m) (Figure 7-3, Page 7-3).

- 5. Install the bolt (2) and lock washer (3) on the upper universal joint and tighten with fingers only.
- 6. Tighten the two nuts (9) to 18 ft-lb (24.4 N-m) (Figure 7-3, Page 7-3).
- 7. Tighten the bolt (2) on the upper universal joint to 15 ft-lb (20.3 N-m) (Figure 7-3, Page 7-3).
- 8. Reinstall center dash panel.
- 9. Reinstall dash pocket and related hardware.

STEERING ADJUSTMENT

Read WARNING on page 7-1.

1. Turn steering wheel all the way to the right. Note the distance between the passenger side spindle stop (2) and the passenger side A-plate (3) (Figure 7-7, Page 7-7). The internal stop on the rack must reach its limit of travel against rack and pinion housing at exactly the same time the spindle stops against the passenger side A-plate (with vehicle wheels turned to the right). If simultaneous contact occurs, steering is in correct adjustment. If simultaneous contact does not occur, proceed to step 2.



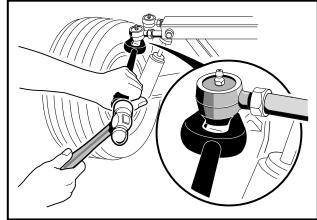


Figure 7-7 Adjust Steering Alignment

Figure 7-8 Remove Ball Joint

2. Loosen the lock nuts (29 and 27) and turn the drag link (28), to adjust length of drag link rod. Adjust the link rod with the steering wheel turned all the way to the right, so the passenger side spindle stop lightly touches the passenger side A-plate. The internal stop on the rack must reach its limit of travel at the same time the spindle stops against the passenger side A-plate (with vehicle wheels turned all the way to the right (Figure 7-15, Page 7-11). See following CAUTION.

A CAUTION

- THE DRAG LINK HAS BOTH LEFT AND RIGHT HAND THREADS. THE END OF THE DRAG LINK TOWARD THE SPINDLE HAS LEFT HAND THREADS, AND THE END TOWARD THE RACK HAS RIGHT HAND THREADS. TO PREVENT DAMAGE TO THREADED PARTS, CARE SHOULD BE TAKEN WHEN SERVICING THE DRAG LINK ROD.
- 3. When all adjustments have been completed, tighten the nuts (29 and 27) on the drag link assembly (Figure 7-13, Page 7-11). See following NOTE.

NOTE

 WHEN TIGHTENING NUTS, MAKE SURE DRAG LINK ROD (28) DOES NOT TURN (FIGURE 7-15, PAGE 7-11).

Steering Adjustment, Continued:

4. Straighten the wheels and turn the steering wheel from lock to lock. Wheels should turn smoothly and easily. If steering wheel does not turn smoothly and easily, inspect the steering assemblies; e.g., ball joints (24) (Figure 7-15, Page 7-11) and (items 6 and 13) (Figure 7-21, Page 7-18), spindle bushings (3 and 4), wave washers (20) (Figure 7-20, Page 7-16), and rack assembly (17) (Figure 7-15, Page 7-11). Also inspect the front suspension assemblies; e.g., A-plate (1) (Figure 7-21, Page 7-18), urethane bushings (2) (Figure 7-21, Page 7-18), and leaf spring (6) (Figure 7-20, Page 7-16). Replace components as necessary. See preceding CAUTION and NOTE.

RACK AND PINION

Read WARNING on page 7-1.

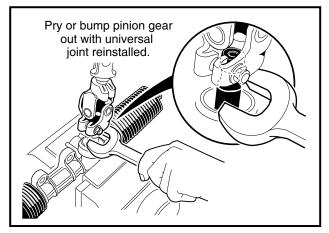
RACK AND PINION REMOVAL

- 1. Remove the front body as instructed in Section 4, Body and Trim.
- 2. Remove the cotter pin (22) and ball joint retaining nut (25) (Figure 7-15, Page 7-11).
- 3. Remove ball joint (23) (Figure 7-15, Page 7-11) from spindle assembly (Figure 7-8, Page 7-7).
- 4. Remove the bolts (30), washers (31), and nuts (32) from the steering rack assembly mounting bracket (Figure 7-15, Page 7-11).
- 5. Loosen the bolt on the upper universal joint, then remove the rack assembly and universal joint from the vehicle (Figure 7-15, Page 7-11).

RACK AND PINION DISASSEMBLY

A CAUTION

- THE BALL JOINT (23) (FIGURE 7-15, PAGE 7-11) HAS LEFT HAND THREADS.
- 1. Remove ball joint (23) (Figure 7-15, Page 7-11) and inspect it for excessive wear.
- 2. Remove the drag link (28) (Figure 7-15, Page 7-11).
- 3. Remove both bellows clamps (2) (Figure 7-15, Page 7-11).
- 4. Remove the hex nut (29) and slide off the dust seal bellows (1) (Figure 7-15, Page 7-11).





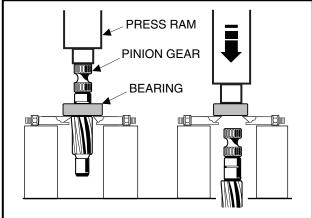
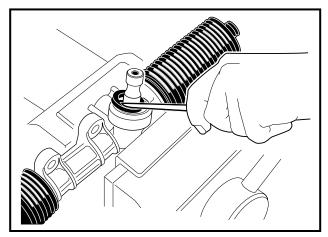


Figure 7-10 Remove Bearing from Pinion

- 5. Remove the retaining ring (21), then slide off dust seal bellows (20) (Figure 7-15, Page 7-11).
- 6. Remove the rack screw lock nut (15), rack guide screw (16), rack guide pressure spring (14), and the rack guide (13) (Figure 7-15, Page 7-11).
- 7. Remove the universal joint assembly from the pinion (8) by fully removing the bolt and then sliding off the universal joint (Figure 7-15, Page 7-11).
- 8. Remove the dust seal (12) (Figure 7-15, Page 7-11). See also Figure 7-11, Page 7-9.

NOTE

• IF THE DUST SEAL (12) IS REMOVED, REPLACE WITH A NEW ONE (FIGURE 7-15, PAGE 7-11).



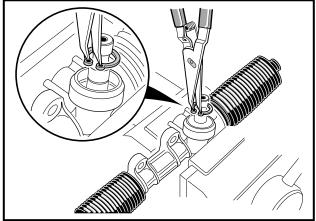


Figure 7-11 Remove Dust Seal

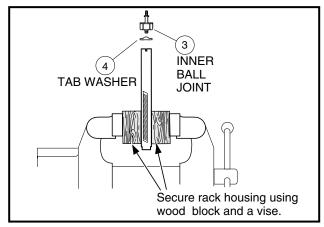
Figure 7-12 Remove Snap Ring

- 9. Remove the internal snap ring (11) (Figure 7-15, Page 7-11). See also Figure 7-12, Page 7-9.
- 10. Install the universal joint onto the pinion and place a large open end wrench under the universal joint (**Figure 7-9**). Use the wrench as a lever to pull the pinion from the housing.
- 11. If the ball bearing (9) has been damaged, remove the external snap ring (10) (Figure 7-15, Page 7-11) and press the bearing off. See also Figure 7-10, Page 7-8.
- 12. Remove the retaining ring (19) and stop washer (18), then remove the rack (17) from the housing (6) (Figure 7-15, Page 7-11).
- 13. If the inner ball joint (3) is excessively worn, remove the ball joint and tab washer (4) from the rack by securing the rack in a vise. Using wood blocks between the rack and the jaws of the vise to protect the rack from damage, loosen and remove the inner ball joint with a wrench (Figure 7-13, Page 7-10).
- 14. Inspect the bushing (5) for excessive wear. If wear is excessive, replace the complete rack and pinion assembly (Figure 7-15, Page 7-11). The bushing (5) should not be replaced and is not available as a service part.

RACK AND PINION ASSEMBLY

- 1. Install a new tab washer (4) and a new inner ball joint (3) (Figure 7-15, Page 7-11). Install the ball joint onto the rack by securing the rack in a vise using wood blocks between the rack and the jaws of the vise to protect the rack from damage (Figure 7-13, Page 7-10). Tighten the ball joint to 58 ft-lb (78.6 N-m).
- 2. Bend the edges of the tab washer (4) up against the ball joint (Figure 7-15, Page 7-11).
- 3. Apply a liberal amount of grease to teeth of rack (17), then slide rack through the bushing (5) and housing (6). Install the stop washer (18) and retaining ring (19) to the end of the rack (Figure 7-15, Page 7-11).

Rack and Pinion Assembly, Continued:



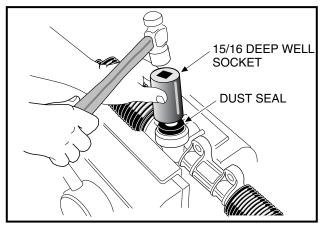


Figure 7-13 Secure Rack in Vise

Figure 7-14 Press in Dust Seal

- 4. If the bearing (9) was removed, press on a new bearing, exerting all pressure on the inner race (grease the bearing before installing it). Then install the external snap ring (10) (Figure 7-15, Page 7-11).
- 5. If the bearing (7) is damaged, the complete rack and pinion assembly must be replaced (Figure 7-15).
- 6. Install pinion (8) and bearing (9) assembly into housing (6). Make sure rack gear teeth will mesh with gear teeth on the pinion. The rack may need to be rotated slightly while lightly tapping on the pinion-bearing assembly with a rubber mallet (Figure 7-15, Page 7-11). See following CAUTION.

A CAUTION

- DO NOT FORCE THE PINION-BEARING ASSEMBLY INTO THE HOUSING. GEAR TEETH OR THE SMALL NEEDLE BEARINGS COULD BE DAMAGED.
- 7. Install the internal snap ring (11) (Figure 7-15, Page 7-11).
- 8. Using a socket to apply pressure evenly, press in a new dust seal (12) (Figure 7-15, Page 7-11). See also Figure 7-14, Page 7-10.
- 9. Apply a small amount of grease to rack guide (13) where it makes contact with rack (17) (Figure 7-15).
- 10. Install a few drops of Loctite[®] 222 to the threads of the screw (16) (Figure 7-15, Page 7-11).
- 11. Install the rack guide (13), pressure spring (14), and screw (16). The screw should be threaded in until tight and then backed off 1/8 of a turn. Install the lock nut (15) on the screw and tighten it to 29 in-lb (3.3 N-m) (Figure 7-15, Page 7-11).
- 12. Install the dust seal bellows (20) and retaining ring (21) (Figure 7-15, Page 7-11).
- 13. Install the hex nut (29) and dust seal bellows (1) (Figure 7-15, Page 7-11).
- 14. Install universal joint (1) (Figure 7-3, Page 7-3) on the pinion (Figure 7-15, Page 7-11). Tighten bolt to 15 ft-lb (20.3 N-m).
- 15. Install new bellows clamps (2) (Figure 7-15, Page 7-11).
- 16. Install the drag link (28) (Figure 7-15, Page 7-11).

A CAUTION

 THE BALL JOINT (23) (FIGURE 7-15, PAGE 7-11) HAS LEFT-HAND THREADS. THE TIE ROD AND DRAG LINK HAVE RIGHT-HAND THREADS ON ONE END AND LEFT-HAND THREADS ON THE OTHER END. RIGHT-HAND THREADS ARE IDENTIFIED BY A GROOVE IN THE TIE ROD OR DRAG LINK. 17. Install the ball joint (23) (Figure 7-13). See previous CAUTION and following NOTE.

NOTE

- TO BE SURE THAT RACK AND PINION IS WORKING PROPERLY, TURN UNIVERSAL JOINT ASSEMBLY BY HAND. IF IT IS TOO TIGHT, LOOSEN LOCK NUT (15) AND BACK THE SCREW (16) OFF 1/8 TURN. THEN TIGHTEN THE LOCK NUT (15) TO 28 FT-LB (38.0 N-M) (Figure 7-15, Page 7-11).
- 18. Adjust the steering gear. See Steering Adjustment, Page 7-7.

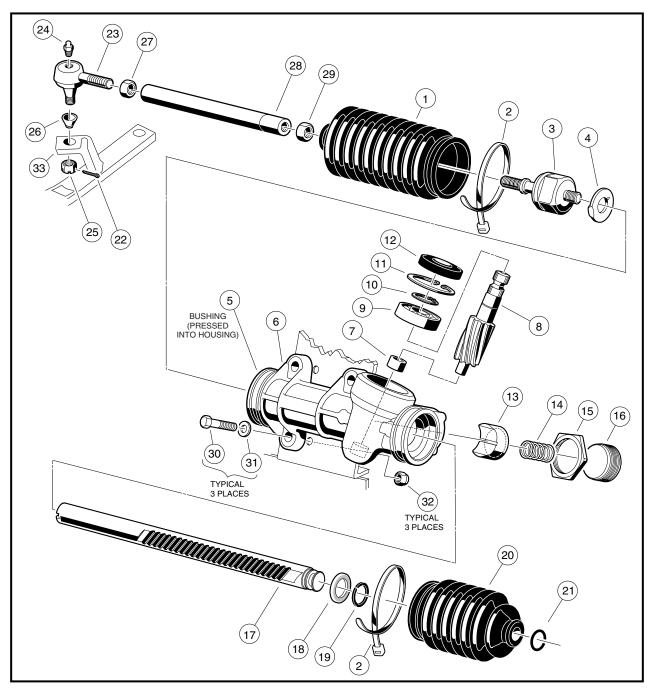


Figure 7-15 Steering Gear Assembly

RACK AND PINION INSTALLATION

- 1. Position the steering rack on the steering rack mounting bracket and install the bolts (30), washers (31), and nuts (32). Do not tighten the mounting bolts (Figure 7-15, Page 7-11).
- 2. For ease of assembly and to prevent corrosion, apply a light coat of anti-seize and lubricating compound to the splined end of the steering column shaft.
- 3. Align the flat portion of the steering shaft spline (20) with the bolt hole in the universal joint (1) and then slide the shaft into the upper universal joint. Install the bolt on the upper universal joint and tighten it to 15 ft-lb (20.3 N-m) (Figure 7-3, Page 7-3).
- 4. Tighten the steering rack mounting bolts (30) to 22 ft-lb (29.8 N-m) (Figure 7-15, Page 7-11).
- 5. Adjust steering. See Steering Adjustment, Page 7-7.

TIE ROD AND DRAG LINK

Read WARNING on page 7-1.

TIE ROD AND DRAG LINK REMOVAL

- 1. Remove the cotter pins (21) and ball joint retaining nuts (20) (Figure 7-21, Page 7-18).
- 2. Remove the ball joints (Figure 7-8, Page 7-7).
- 3. Unscrew the drag link (28) from the inner ball joint assembly (3) (Figure 7-15, Page 7-11). Remove the ball joints (6 and 13) from the tie rod (11) (Figure 7-21, Page 7-18).

TIE ROD AND DRAG LINK INSTALLATION

1. Thread the ball joints (6 and 13) into the tie rod (11) to thread depth of 1/2 inch (12.5 mm) (Figure 7-21, Page 7-18).

WARNING

THE BALL JOINTS MUST BE THREADED INTO THE ROD AT LEAST 5/16 INCH (8 MM). FAILURE
TO THREAD BALL JOINTS IN DEEP ENOUGH MAY CAUSE A BALL JOINT TO SEPARATE FROM
THE ROD DURING ADJUSTMENT OR WHILE BEING OPERATED, POSSIBLY RESULTING IN
SEVERE PERSONAL INJURY.

A CAUTION

- THE TIE ROD AND DRAG LINK HAVE RIGHT-HAND THREADS ON ONE END AND LEFT-HAND THREADS ON THE OTHER END. RIGHT-HAND THREADS ARE IDENTIFIED BY A GROOVE IN THE TIE ROD OR DRAG LINK.
- 2. Install the ball joint ends (6 and 13) into the spindle arms (23) (Figure 7-21, Page 7-18).
- 3. Thread the drag link rod (28) all the way onto the threaded stud of the inner ball joint assembly (3) (right-hand threads) (Figure 7-15, Page 7-11).
- 4. Thread the ball joint (23) into the drag link rod (28) (left-hand threads) to full thread depth (Figure 7-15, Page 7-11).
- 5. Install the ball joint (23) on the spindle arm riser (33), then install the retaining nut (25) (Figure 7-15, Page 7-11). Tighten nut (25) to 18 ft-lb (24.4 N-m), then install cotter pin (22).
- 6. Adjust wheel toe-in. See page 7-14.
- 7. Adjust steering adjustment. See page 7-7.

FRONT SUSPENSION

Read WARNING on page 7-1.

LUBRICATION

Five grease fittings are provided (one in each spindle housing, one in the ball joint on each end of the tie rod, and one in the ball joint of the steering drag link). Lubricate at these fittings at the recommended interval with a good lubricant. See the Lubrication Chart in Section 10 in the appropriate Maintenance and Service Supplement. See following CAUTION.

A CAUTION

• TO ENSURE PROPER LUBRICATION OF THE FRONT SUSPENSION AND STEERING LINKAGES. RAISE FRONT OF VEHICLE TO LUBRICATE. SEE WARNING ON PAGE 7-1.

WHEEL ALIGNMENT

Wheel alignment is limited to equalizing the camber angle of each front wheel and adjusting toe-in of the front wheels. There is also a drag link adjustment to equalize the turning radius in both directions. See Steering Adjustment, Page 7-7.

NOTE

 WHENEVER THE VEHICLE MUST BE MOVED DURING THE ALIGNMENT PROCESS, ALWAYS ROLL THE VEHICLE FORWARD. DO NOT ROLL IT BACKWARD.

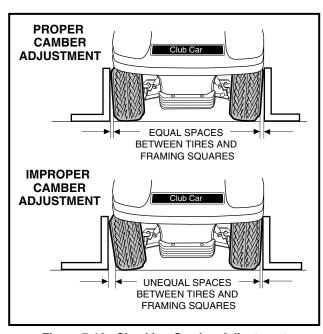


Figure 7-16 Checking Camber Adjustment

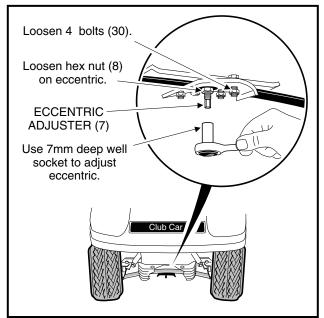


Figure 7-17 Adjust Camber

Camber Adjustment

1. Check each front wheel with a framing square. Place a framing square next to each tire as shown (Figure 7-16, Page 7-13) at the floor (or ground), there should be an equal amount of space between each tire and the framing square.

Camber Adjustment, Continued:

- 2. If adjustment is necessary, loosen (do not remove) the four bolts (30) that secure the leaf spring (6) to the bottom spring plate (29) (Figure 7-20, Page 7-16).
- 3. Loosen (do not remove) hex nut (8) on adjustment eccentric (7) in center of the spring (Figure 7-20, Page 7-16).
- 4. Using a 7 mm deepwell socket, rotate the eccentric to achieve an equal amount of space between the framing square and the tires (Figures 7-16 and 7-17, Page 7-13).
- 5. After aligning front wheels, tighten four spring retaining bolts (30) (Figure 7-20, Page 7-16) to 23 ft-lb (31 N-m). Then roll vehicle forward one full tire revolution and recheck camber (Figure 7-16, Page 7-13).
- 6. Tighten the hex nut (8) on the adjustment eccentric (7) to 10 ft-lb (13.5 N-m) (Figure 7-20, Page 7-16).

Toe-in Adjustment

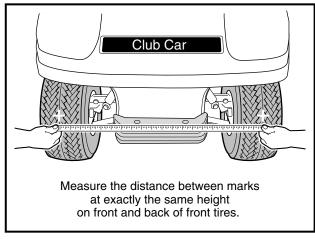
- On a level surface, roll the vehicle to a stop with the front wheels pointed straight ahead. Do not turn the steering wheel again during this procedure.
- On each front tire, mark (as closely as possible) the center of the tread face that is oriented toward the rear of the vehicle. The marks should be the same height from the floor as from the bottom surfaces of the vehicle frame I-beams.
- Measure the distance between the marks on the rear-facing surfaces of the tires, and then roll the vehicle forward one and one-half wheel revolutions until the marks appear on the forward-facing surfaces of the tires at about the same height from the floor (Figure 7-18, Page 7-15).
- 4. Measure the distance between the marks on the forward-facing surfaces of the tires.

NOTE

- THE FRONT MEASUREMENT MUST BE LESS THAN THE REAR MEASUREMENT.
- 5. Subtract the measurement on the front of the tires from the measurement on the rear of the tires. The difference is the toe-in. Proper toe-in is 1/8 to 3/8 of an inch (3.2 to 9.5 mm).
- 6. If adjustment is necessary, loosen the lock nut on each tie rod ball joint and rotate the tie rod to increase or decrease toe-in (Figure 7-17). See following CAUTION.

A CAUTION

- THE TIE ROD HAS RIGHT-HAND THREADS ON ONE END AND LEFT-HAND THREADS ON THE OTHER END. RIGHT-HAND THREADS ARE IDENTIFIED BY A GROOVE IN THE TIE ROD.
- 7. Check toe-in again to confirm proper adjustment.
 - 7.1. Roll vehicle forward one and one half tire revolutions and again measure rear-facing marks.
 - 7.2. Roll the vehicle forward and again measure forward-facing marks. Subtract the front measurement from the rear measurement to confirm adjustment.
 - 7.3. If toe-in is incorrect, go back to Step 3.
- 8. Tighten lock nuts (loosened in Step 6) to 21 ft-lb (31 N-m) and recheck toe-in.



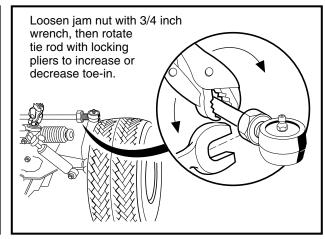


Figure 7-18 Check Toe-in

Figure 7-19 Adjust Toe-in

9. After toe-in adjustment is made, with the tires in the straight ahead position, the steering wheel should be at the center of its travel. There should be equal travel to the left and right. See following NOTE.

NOTE

- IF THE MINIMUM TURNING RADIUS IS NOT THE SAME FOR BOTH LEFT AND RIGHT TURNS, ADJUST THE STEERING (SEE PAGE 7-7).
- IF THE VEHICLE IS EQUIPPED WITH THE PERMANENT TOWING OR DELUXE ON-BOARD TOWING OPTION, ADJUST BY LOOSENING THE BALL JOINT HEX NUT ON THE TOW ASSEMBLY AND ROTATING THE STEERING ARM TO ACHIEVE 16-1/2 INCH (42 CM) FROM CENTERLINE OF RIGHT FRONT TIRE TO THE CLOSEST EDGE OF THE HOLE IN TOWING LUG.

FRONT SUSPENSION COMPONENTS

Read WARNING on page 7-1.

TAPERED LEAF SPRING REMOVAL

- 1. Loosen, but do not remove, the lug nuts on both front wheels. Raise the front of the vehicle with a chain hoist or a jack. Place jackstands under the front cross tube of the vehicle frame and lower the vehicle onto the jackstands. See WARNING on page 7-1.
- 2. Remove lug nuts then remove both front wheels.
- 3. Remove the nuts (14) and bolts (25) from each lower kingpin clevis (26) (Figure 7-20, Page 7-16).
- 4. Remove four bolts (30), four nuts (32), four lock washers (31), and bottom spring plate (29) (Figure 7-20, Page 7-16).
- 5. Remove tapered leaf spring (6) (Figure 7-20, Page 7-16).
- 6. Check the condition of the bushings (27) and spacers (28) (Figure 7-20, Page 7-16). Replace any that are worn or damaged.

TAPERED LEAF SPRING INSTALLATION

- 1. Install the bushings (27) and spacers (28) into the tapered leaf spring eyes (Figure 7-20, Page 7-16).
- 2. Install the tapered leaf spring (6), bottom spring plate (29), four bolts (30), four lock washers (31), and four nuts (32) (Figure 7-20, Page 7-16). Using an "X" pattern sequence, tighten the bolts to 23 ft-lb (31.2 N-m).

Tapered Leaf Spring Installation, Continued:

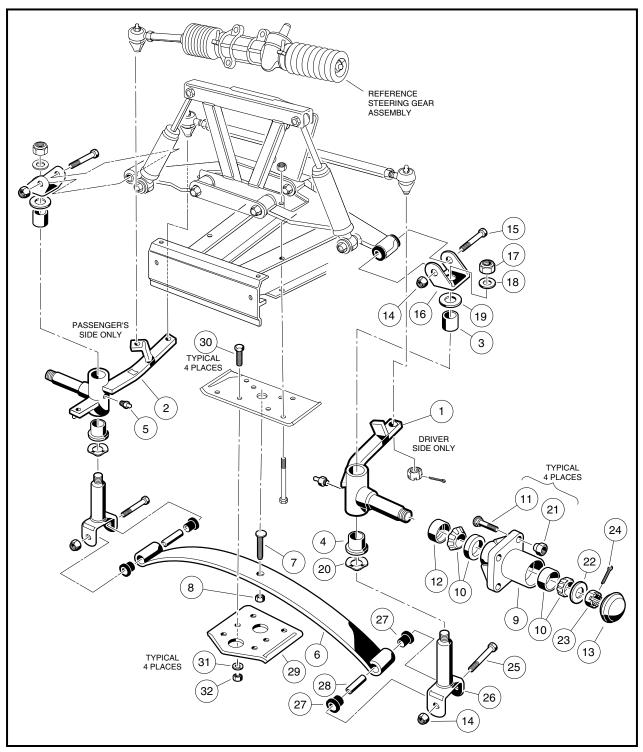


Figure 7-20 Lower Front Suspension Assembly

- 3. Install the spring in the kingpin clevis with the bolt (25) and nut (14) (Figure 7-20, Page 7-16). Tighten the bolt to 23 ft-lb (31 N-m).
- 4. Install the wheels. See Section 8, Wheels and Tires, Page 8-2.
- 5. Adjust camber and toe-in as instructed on pages 7-13 and 7-14 of this manual.

KINGPIN AND STEERING SPINDLE REMOVAL

- 1. Remove the front hub. See Front Wheel Bearings And Hub Removal, Page 7-19.
- 2. Remove cotter pins (21) and nuts (20), then remove ball joints from the spindles (Figure 7-21, Page 7-18). See Tie Rod and Drag Link Removal, Page 7-12.
- 3. Remove the nut (17) and lock washer (18) from the top of the kingpin (26) (Figure 7-20, Page 7-16)
- 4. Raise the A-Plate clevis (16) from the kingpin (Figure 7-20, Page 7-16).
- 5. Remove the thrust washer (19) (Figure 7-20, Page 7-16).
- 6. Slide the spindle (1) off the kingpin (Figure 7-20, Page 7-16).
- 7. Remove the wave washer (20) and inspect it (Figure 7-20, Page 7-16). If the washer is broken or has a wave bottom to wave crest height dimension of less than .040, it must be replaced.
- 8. Remove the bolt (25) and nut (14) from the lower kingpin clevis (Figure 7-20, Page 7-16).
- 9. Remove the kingpin.
- 10. Inspect the kingpin and spindle. If either is worn or damaged, it must be replaced.
- 11. Inspect the bushings (3 and 4) (Figure 7-20, Page 7-16). If the bushings are worn or damaged, remove them and press in new ones. See following NOTE.

NOTE

• IF BUSHINGS ARE REPLACED, REAM NEW BUSHINGS TO .750 -.752 INCH (19.05-19.10 MM) IN DIAMETER. REAMER SHOULD BE LONG ENOUGH TO REAM BOTH BUSHINGS FROM ONE DIRECTION.

KINGPIN AND STEERING SPINDLE INSTALLATION

- 1. Inspect all parts and replace them as necessary.
- 2. Install the kingpin (26) over the tapered leaf spring eye. Insert the bolt (25) and install the nut (14) (Figure 7-20, Page 7-16). Tighten the bolt to 23 ft-lb (31 N-m).
- 3. Install the wave washer (20) on the kingpin (Figure 7-20, Page 7-16).
- 4. Install the steering spindle on the kingpin. Then install the thrust washer (19), A-Plate clevis (16), flat washer (18), and nut (17). Tighten the nut to 40 ft-lb (54.2 N-m) (Figure 7-20, Page 7-16).
- 5. Attach the ball joints to the spindle arms, install and tighten the nut (20), and install the cotter pin (21) (Figure 7-21, Page 7-18).
- 6. Install the front hub and wheel. See Front Wheel Bearings And Hub Installation, Page 7-19.

DELTA A-PLATE REMOVAL

- 1. Remove the wheel and tire.
- 2. Remove the bolts (10), A-Plate straps (14), and nuts (5) (Figure 7-21, Page 7-18).
- 3. Remove the lower shock absorber mounting nut (9), then slide the shock absorber free of the Delta A-Plate (Figure 7-21, Page 7-18).
- 4. Remove the Delta A-Plate (1) (Figure 7-21, Page 7-18).
- 5. Inspect the bushings (2) in the Delta A-Plate and replace them if necessary.

DELTA A-PLATE INSTALLATION

- 1. Install the A-Plate in reverse order of removal. Tighten the A-Plate suspension bolts (10 and 24) to 20 ft-lb (27.1 N-m) (Figure 7-21, Page 7-18).
- Tighten shock absorber mounting nut (9) to 20 ft-lb (27.1 Nm).
- 3. Install the wheel and adjust the camber as instructed on page 7-12 of this manual.

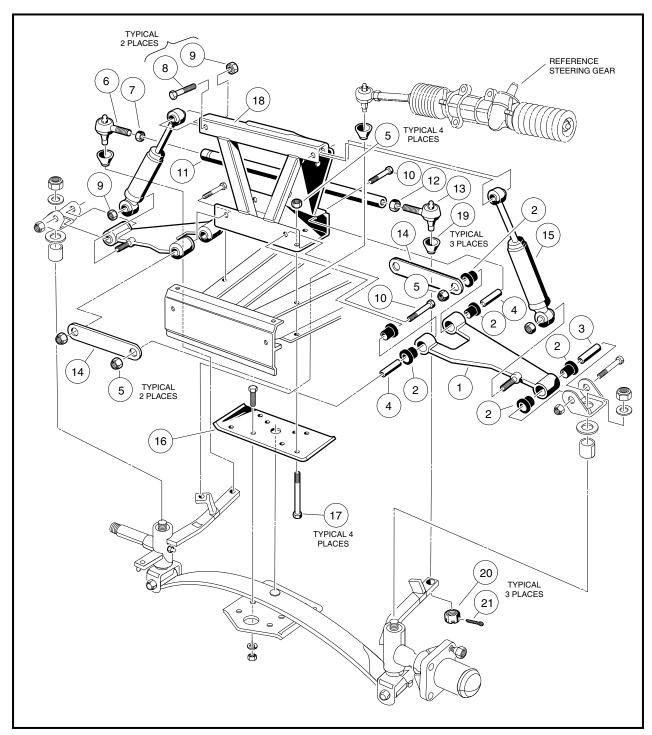


Figure 7-21 Upper Front Suspension Assembly

SHOCK ABSORBER REMOVAL

- 1. Inspect the shock absorbers for fluid leakage at the point where the shaft enters the shock absorber body. Leaking shock absorbers should be replaced.
- 2. Remove the nut (9) attaching the shock absorber to the A-Plate (Figure 7-21, Page 7-18).
- 3. Remove nut (9) and bolt (8) attaching shock absorber to the vehicle frame (Figure 7-21, Page 7-18).
- 4. Remove the shock absorber.

SHOCK ABSORBER INSTALLATION

- 1. Install the shock absorber by reversing the removal procedure.
- 2. Tighten the nuts to 20 ft-lb (27 N-m).

FRONT WHEEL BEARINGS AND HUBS

Read WARNING on page 7-1.

CHECK FRONT WHEEL FREE PLAY

- 1. Raise the front of the vehicle.
- 2. Using your hands, attempt to rock the wheel and hub assembly back and forth on the spindle. If there is any observable movement of the wheel and hub on the spindle, remove dust cap (1) and cotter pin(2) and then tighten the spindle nut (3) until the bearing (5) fully seats in the bearing race (7).
- 3. Loosen spindle nut one cotter pin position. If the hub does not turn freely, loosen spindle nut one more cotter pin position.
- 4. Install a new cotter pin (2). If movement continues, replace the wheel bearings (5) as required (Figure 7-22, Page 7-19).

FRONT WHEEL BEARINGS AND HUB REMOVAL

- Remove the front wheels.
- 2. Remove the front wheel hubs.
 - 2.1. Remove dust cover (1), cotter pin (2), spindle nut (3), and flat washer (8) (Figure 7-22, Page 7-19).
 - 2.2. Remove the hub assembly (4) from the spindle shaft (Figure 7-22, Page 7-19).
- 3. Remove the seal (6) and the bearings (5) from the hub (Figure 7-22, Page 7-19).
- 4. Inspect the bearing cups (7). If they are worn or pitted, remove the cups by inserting a drift punch from the opposite end of the hub and tapping lightly around them (Figure 7-22, Page 7-19).
- 5. Clean all parts and inspect them for wear. Replace any damaged or worn parts.
- 6. Inspect surface of the spindle shaft where the oil seal (6) seats. It should be clean and smooth.

FRONT WHEEL BEARINGS AND HUB INSTALLATION

- 1. Pack the wheel bearings (5) and hub cavity with wheel bearing grease or chassis lube. Make sure that the grease is forced between the rollers (Figure 7-22, Page 7-19).
- 2. If the bearing cups (7) were removed, press new ones in squarely against the stop in the hub.

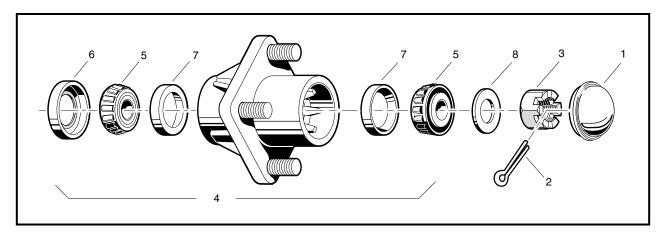


Figure 7-22 Wheel Hub Assembly

NOTE

- ALWAYS INSTALL NEW CUPS WHEN NEW BEARINGS ARE INSTALLED.
- 3. Install the wheel bearings (5) into the hub and install a new seal (6), with the metal edge toward the hub. (Figure 7-22, Page 7-19). See following NOTE.

NOTE

- APPLY GREASE AROUND DUST SEAL LIP BEFORE INSTALLATION.
- 4. Install the hub assembly (4) and flat washer (8) on the axle and start the spindle nut (3).
- 5. Tighten the spindle nut until the hub is hard to turn, then back the nut off until the hub turns freely. Install a **new** cotter pin (2) **(Figure 7-22, Page 7-19)**.

NOTE

- WHEN THE COTTER PINS ARE BENT OVER, MAKE SURE THEY DO NOT CONTACT THE HUB OR DUST CAP.
- 6. Check front wheel free play. See page 7-19.
- 7. Install the dust cap (1) (Figure 7-22, Page 7-19).
- 8. Repeat the procedure for the opposite wheel.
- 9. Install the wheel and finger tighten lug nuts.
- 10. Lower the vehicle to the ground and tighten the lug nuts, using a crisscross pattern, to 55 ft-lb (74.6 N-m).

SECTION 8-WHEELS AND TIRES

A WARNING

- ONLY TRAINED TECHNICIANS SHOULD REPAIR OR SERVICE THIS VEHICLE. ANYONE DOING EVEN SIMPLE REPAIRS OR SERVICE SHOULD HAVE KNOWLEDGE AND EXPERIENCE IN ELECTRICAL AND MECHANICAL REPAIR.
- FOLLOW ALL PROCEDURES EXACTLY AS STATED IN THIS MANUAL, AND HEED ALL DANGER, WARNING, AND CAUTION STATEMENTS LISTED IN THIS MANUAL AS WELL AS THOSE AFFIXED TO THE VEHICLE.
- WEAR SAFETY GLASSES OR APPROVED EYE PROTECTION WHILE SERVICING VEHICLE. WEAR A FULL FACE SHIELD WHEN WORKING WITH BATTERIES.
- MOVING PARTS! DO NOT ATTEMPT TO SERVICE THE VEHICLE WHILE IT IS RUNNING.
- USE INSULATED TOOLS WHEN WORKING NEAR BATTERIES OR ELECTRICAL CONNECTIONS. USE EXTREME CAUTION TO AVOID SHORTING OF COMPONENTS OR WIRING.
- LIFT ONLY ONE END OF VEHICLE AT A TIME. BEFORE LIFTING, LOCK BRAKES AND CHOCK THE WHEELS THAT REMAIN ON THE FLOOR. USE A SUITABLE LIFTING DEVICE (CHAIN HOIST OR HYDRAULIC FLOOR JACK) WITH 1000 LB. (454 KG.) MINIMUM LIFTING CAPACITY. DO NOT USE THE LIFTING DEVICE TO HOLD VEHICLE IN RAISED POSITION. ALWAYS USE APPROVED JACKSTANDS OF PROPER WEIGHT CAPACITY TO SUPPORT THE VEHICLE.
- TURN KEY SWITCH **OFF**, PLACE FORWARD/REVERSE HANDLE IN **NEUTRAL**, REMOVE KEY, CHOCK WHEELS, AND DISCONNECT THE BATTERY(IES) BEFORE SERVICING THE VEHICLE.

GASOLINE VEHICLES ONLY:

- TO AVOID UNINTENTIONALLY STARTING THE VEHICLE:
 - DISCONNECT BATTERY CABLES, NEGATIVE (-) FIRST (SECTION 1, FIGURE 1-1).
 - DISCONNECT THE SPARK PLUG WIRE FROM THE SPARK PLUG.
- FRAME GROUND DO NOT ALLOW TOOLS OR OTHER METAL OBJECTS TO CONTACT FRAME WHEN DISCONNECTING BATTERY CABLES OR OTHER ELECTRICAL WIRING. NEVER ALLOW A POSITIVE WIRE TO TOUCH THE VEHICLE FRAME, ENGINE, OR OTHER METAL COMPONENT.

ELECTRIC VEHICLES ONLY:

- TO AVOID UNINTENTIONALLY STARTING THE VEHICLE, DISCONNECT BATTERIES AS SHOWN (SECTION 1, FIGURE 1-2 OR 1-3).
- ON POWERDRIVE PLUS VEHICLES, PLACE THE TOW SWITCH IN THE **TOW** POSITION **BEFORE** DISCONNECTING BATTERIES.
- ON POWERDRIVE SYSTEM 48 VEHICLES, DISCHARGE THE CONTROLLER AS FOLLOWS **AFTER** DISCONNECTING THE BATTERIES:
 - TURN THE KEY SWITCH TO **ON** AND PLACE THE FORWARD/REVERSE HANDLE IN THE **REVERSE** POSITION.
 - SLOWLY DEPRESS THE ACCELERATOR PEDAL AND KEEP IT DEPRESSED UNTIL THE REVERSE WARNING BUZZER CAN NO LONGER BE HEARD. WHEN THE BUZZER STOPS SOUNDING, THE CONTROLLER IS DISCHARGED.

GENERAL INFORMATION

Maximum tire life and good vehicle handling qualities are directly related to proper wheel and tire care.

• Keep tires inflated to 12 -14 psi (83-96 kPa) for gasoline vehicles; 18-20 psi (124-138 kPa) for electric vehicles.

WHEELS AND TIRES Wheels

General Information, Continued:

- Keep lug nuts properly torqued.
- · Keep the front end aligned and adjusted.

WHEELS

Read WARNING on page 8-1.

WHEEL REMOVAL

- 1. Slightly loosen the lug nuts on the wheel to be removed.
- Raise the end of the vehicle from which the wheel is to be removed. Make sure that the wheels are off the ground. See WARNING on page 8-1.
- 3. Remove the lug nuts and remove the wheel.

WHEEL INSTALLATION

- 1. Install wheel(s), and tighten the lug nuts (using a crisscross pattern) until they are snug.
- 2. Lower the vehicle and finish tightening lug nuts (using a crisscross pattern) to 55 ft-lb (74.6 N-m).

TIRES

TIRE REMOVAL

NOTE

- TIRE MUST BE REMOVED OR INSTALLED FROM THE VALVE STEM SIDE OF THE RIM.
- Remove the tire and wheel assembly from the vehicle as instructed above.
- 2. Remove the valve cap and valve core and allow air to escape from the tire.
- 3. If possible, use a tire machine to remove the tire from the rim.
 - 3.1. If a tire machine is not available, loosen both tire beads by applying pressure to the tire side walls and pushing the tire bead away from the rim flange and into the rim well (Figure 8-1, Page 8-3).
 - 3.2. With the valve stem side of the wheel up, use a tire tool to carefully start the upper bead over the edge of the wheel rim (Figure 8-1, Page 8-3).

A CAUTION

- TO AVOID DAMAGE TO THE TIRE, DO NOT USE EXCESSIVE FORCE WHEN STARTING THE BEAD OVER THE EDGE OF THE RIM.
 - 3.3. When top bead is free of the rim, pull the bead from the bottom side of the rim up into the upper part of the rim well. Insert the tire tool under the lower bead as shown (Figure 8-1, Page 8-3) and carefully pry the lower bead over the rim flange.

Once the lower bead is started over the rim flange, the tire can be removed from the rim by hand.

TIRE REPAIR

- 1. Determine the location and cause of the air leak:
 - 1.1. Remove the wheel **(see Wheel Removal, page 8-2)** and inflate the tire to no more than 20 psi (138 kPa).
 - 1.2. Immerse the tire in water and then mark the point where bubbles are formed by escaping air.

Tires 8

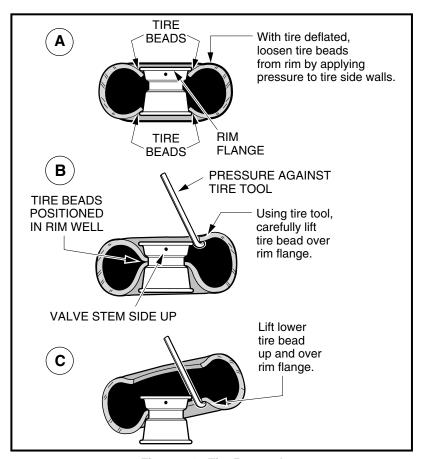


Figure 8-1 Tire Removal

1.3. Determine the cause of the air leak. See following NOTE.

NOTE

- AN AIR LEAK COULD BE DUE TO A PUNCTURED CASING, FAULTY VALVE CORE, IMPROPERLY SEATED VALVE STEM, OR IMPROPERLY SEATED TIRE BEAD.
- SMALL HOLES IN THE CASING CAN BE PLUGGED USING A STANDARD AUTOMOTIVE TUBELESS TIRE REPAIR KIT AVAILABLE AT AUTO SUPPLY STORES.
- 2. When the cause of the air leak has been determined, remove tire from the rim (see Tire Removal, page 8-2) and repair as required.

TIRE INSTALLATION

WARNING

- WHILE MOUNTING OR INFLATING TIRE, KEEP HANDS, FINGERS, ETC. FROM EXPOSED AREAS BETWEEN THE TIRE BEAD AND RIM.
- 1. Clean both tire beads to remove dirt or other foreign matter.
- 2. Where the tire beads seat, clean the wheel rim with a wire brush.

WHEELS AND TIRES Tires

Tire Installation, Continued:

NOTE

• BECAUSE TUBELESS TIRES REQUIRE A PERFECT SEAL IN ORDER TO SEAT, CLEANING OF THE TIRE AND RIM IS VERY IMPORTANT.

- 3. Apply plenty of tire mounting lubricant (soap and water solution) to both tire beads and rim flanges.
- 4. Install the tire on the rim from the valve stem side. If there is no tire machine available, use a rubber mallet and tire iron.
- 5. Remove the valve core and position tire so that both beads are on the rim flange narrow bead seats.
- 6. Place tire and wheel assembly against wall in upright position and push it against wall while inflating tire to 30-35 psi (207-242 kPa). The three-point contact (wall, floor, and hand) will help ensure that beads snap into place and form a proper seal as tire is inflated (Figure 8-2, Page 8-4). See following WARNING.

A WARNING

DO NOT USE A COMPRESSED AIR SOURCE WITH PRESSURE OVER 100 PSI (690 KPA). DUE
TO LOW PRESSURE REQUIREMENTS OF A SMALL TIRE, OVER-INFLATION COULD BE
REACHED ALMOST INSTANTLY WITH A HIGH PRESSURE AIR SUPPLY. OVER-INFLATION
COULD CAUSE TIRE TO EXPLODE, POSSIBLY RESULTING IN SEVERE PERSONAL INJURY.

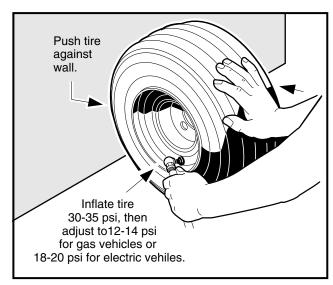


Figure 8-2 Inflate Tire

- 7. Quickly remove the air nozzle and install the valve core.
- 8. Adjust air pressure in tire to 12 -14 psi (83-96 kPa) for gas vehicles, or 18-20 psi (124-138 kPa) for electric vehicles, and then immerse the wheel and tire assembly in water to make sure there are no leaks.

SECTION 9-REAR SUSPENSION

GENERAL INFORMATION

The rear suspension of the DS vehicle is completely independent. It consists of two leaf springs controlled by two shock absorbers mounted between the springs and the vehicle frame.

WARNING

- ONLY TRAINED TECHNICIANS SHOULD REPAIR OR SERVICE THIS VEHICLE. ANYONE DOING EVEN SIMPLE REPAIRS OR SERVICE SHOULD HAVE KNOWLEDGE AND EXPERIENCE IN ELECTRICAL AND MECHANICAL REPAIR.
- FOLLOW ALL PROCEDURES EXACTLY AS STATED IN THIS MANUAL, AND HEED ALL DANGER, WARNING, AND CAUTION STATEMENTS LISTED IN THIS MANUAL AS WELL AS THOSE AFFIXED TO THE VEHICLE.
- WEAR SAFETY GLASSES OR APPROVED EYE PROTECTION WHILE SERVICING VEHICLE. WEAR A FULL FACE SHIELD WHEN WORKING WITH BATTERIES.
- MOVING PARTS! DO NOT ATTEMPT TO SERVICE THE VEHICLE WHILE IT IS RUNNING.
- USE INSULATED TOOLS WHEN WORKING NEAR BATTERIES OR ELECTRICAL CONNECTIONS. USE EXTREME CAUTION TO AVOID SHORTING OF COMPONENTS OR WIRING.
- LIFT ONLY ONE END OF THE VEHICLE AT A TIME. BEFORE LIFTING, LOCK THE BRAKES AND CHOCK THE WHEELS THAT REMAIN ON THE FLOOR. USE A SUITABLE LIFTING DEVICE (CHAIN HOIST OR HYDRAULIC FLOOR JACK) WITH 1000 LB. (454 KG.) MINIMUM LIFTING CAPACITY. DO NOT USE LIFTING DEVICE TO HOLD VEHICLE IN RAISED POSITION. ALWAYS USE APPROVED JACKSTANDS OF PROPER WEIGHT CAPACITY TO SUPPORT THE VEHICLE.
- TURN KEY SWITCH **OFF**, PLACE FORWARD/REVERSE HANDLE IN **NEUTRAL**, REMOVE KEY, CHOCK THE WHEELS, AND DISCONNECT BATTERY(IES) BEFORE SERVICING VEHICLE.

GASOLINE VEHICLES ONLY:

- TO AVOID UNINTENTIONALLY STARTING THE VEHICLE:
 - DISCONNECT BATTERY CABLES, NEGATIVE (-) FIRST (FIGURE 1-1, SECTION 1).
 - DISCONNECT THE SPARK PLUG WIRE FROM THE SPARK PLUG.
- FRAME GROUND DO NOT ALLOW TOOLS OR OTHER METAL OBJECTS TO CONTACT FRAME WHEN DISCONNECTING BATTERY CABLES OR OTHER ELECTRICAL WIRING. NEVER ALLOW A POSITIVE WIRE TO TOUCH THE VEHICLE FRAME, ENGINE, OR OTHER METAL COMPONENT.

ELECTRIC VEHICLES ONLY:

- TO AVOID UNINTENTIONALLY STARTING THE VEHICLE, DISCONNECT BATTERIES AS SHOWN IN SECTION 1, FIGURES 1-2 OR 1-3.
- ON POWERDRIVE PLUS VEHICLES, PLACE THE TOW SWITCH IN THE **TOW** POSITION **BEFORE** DISCONNECTING BATTERIES.
- ON POWERDRIVE SYSTEM 48 VEHICLES, DISCHARGE THE CONTROLLER AS FOLLOWS **AFTER** DISCONNECTING THE BATTERIES:
 - TURN THE KEY SWITCH TO **ON** AND PLACE THE FORWARD/REVERSE HANDLE IN THE **REVERSE** POSITION.
 - SLOWLY DEPRESS THE ACCELERATOR PEDAL AND KEEP IT DEPRESSED UNTIL THE REVERSE WARNING BUZZER CAN NO LONGER BE HEARD. WHEN THE BUZZER STOPS SOUNDING, THE CONTROLLER IS DISCHARGED.

REAR SUSPENSION General Information

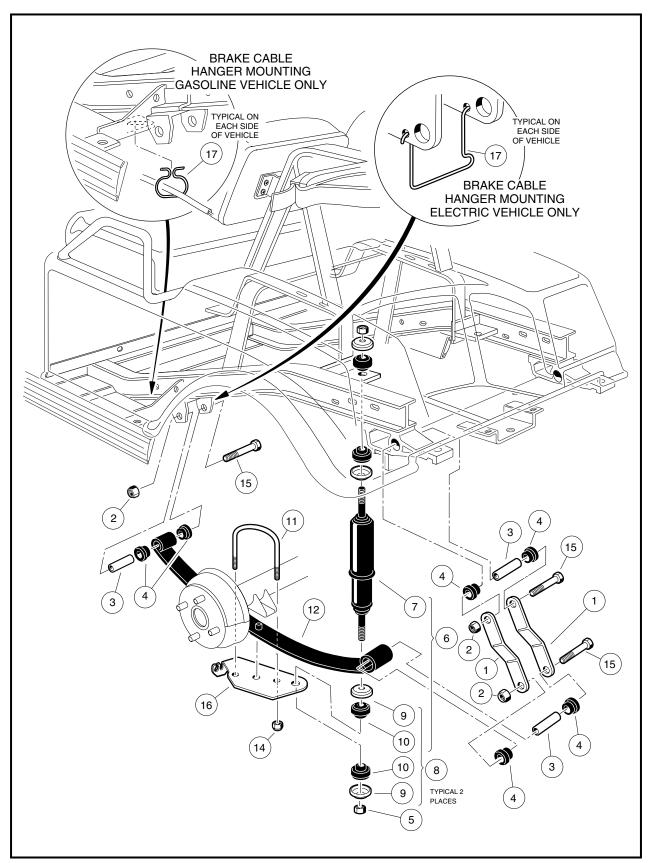


Figure 9-1 Rear Suspension Assembly and Mounting

SHOCK ABSORBERS

INSPECTING AND REMOVING SHOCK ABSORBERS

1. Check shock absorbers (7) for fluid leakage at the point where the shaft enters the shock absorber body. Replace leaking shock absorbers (Figure 9-1, Page 9-2).

- 2. To remove a shock absorber, remove the nut (5), cup washer (9) and rubber bushing (10) from the stem at the top of the shock absorber (Figure 9-1, Page 9-2).
- 3. Remove the nut (5), cup washer (9), and rubber bushing (10) from lower mounting stem (Figure 9-1, Page 9-2).
- 4. Compress the shock absorber to remove it.

INSTALLING SHOCK ABSORBERS

- 1. To install, reverse the removal procedure.
- 2. On the upper and lower shock absorber mounting stems, tighten the nuts until the rubber bushing expands to the size of the cup washer.

LEAF SPRINGS

REMOVING THE LEAF SPRINGS

 Loosen, but do not remove, lug nuts on tire and wheel assembly on the side from which the spring is to be removed. Place chocks at the front wheels and lift the rear of the vehicle with a chain hoist or floor jack. Position jackstands under the frame cross-member between the spring mount and the side stringer, just forward of each rear wheel. Lower the vehicle to let the jackstands support the vehicle (Figure 9-2, Page 9-3). See following WARNING.

A WARNING

 LIFT ONLY ONE END OF THE VEHICLE AT A TIME. BEFORE LIFTING, LOCK THE BRAKES AND CHOCK THE WHEELS THAT REMAIN ON THE FLOOR. USE A SUITABLE LIFTING DEVICE (CHAIN HOIST OR HYDRAULIC FLOOR JACK) WITH 1000 LB. (454 KG.) MINIMUM LIFTING CAPACITY. DO NOT USE LIFTING DEVICE TO HOLD VEHICLE IN RAISED POSITION. ALWAYS USE APPROVED JACKSTANDS OF PROPER WEIGHT CAPACITY TO SUPPORT THE VEHICLE.

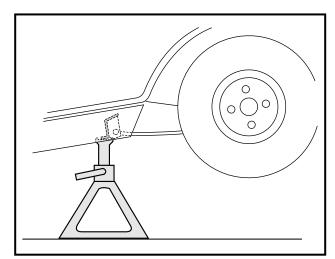


Figure 9-2 Support Vehicle on Jackstands

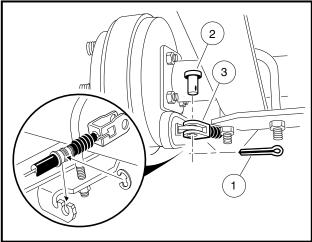


Figure 9-3 Disconnect Brake Cable

Page 9-3

REAR SUSPENSION Leaf Springs

Removing the Leaf Springs, Continued:

2. Place a floorjack under the transaxle differential casing to support (but not lift) the drivetrain. Raise it just enough to relieve tension on the shock absorbers without compressing them.

- 3. Remove the tire and wheel assembly on the side from which the spring is to be removed.
- 4. Remove the cotter pin (1) and the clevis pin (2) at the brake lever and brake cable connection and pull the clevis (3) away from the lever (Figure 9-3, Page 9-3). Detach the brake cable from the shock mount bracket (16) (Figure 9-1, Page 9-2).
- 5. Remove the nut (5), cup washer (9), and rubber bushing (10) from the lower mounting stem of the shock absorber (Figure 9-1, Page 9-2).
- 6. Remove the nuts (14) and the U-bolt (11) securing the spring to the transaxle (Figure 9-1, Page 9-2). Remove the shock mount bracket (16) and the U-bolt.
- 7. Remove the bolt (15) and nut (2) attaching the rear spring to the shackle (1) (Figure 9-1, Page 9-2).
- 8. Remove the nut (2) and bolt (15) attaching the front of the spring to the vehicle frame (Figure 9-1, Page 9-2) and remove the spring.
- 9. Inspect the bushings (4) and spacers (3) in the spring eyes and replace them if they are worn or damaged (Figure 9-1, Page 9-2).

INSTALLING THE LEAF SPRINGS

1. To install the springs, reverse the removal procedure. **See following CAUTION**.

A CAUTION

- WHEN POSITIONING THE SPRING ON THE TRANSAXLE, BE SURE TO INSERT THE LOCATING BOLT ON THE SPRING IN THE LOCATING HOLE IN THE TRANSAXLE SADDLE.
- 2. Tighten the nuts on the U-bolts to 25 ft-lb (34 N-m).
- 3. Tighten nylon locknuts (2) on spring mounting bolts (15) to 15 ft-lb (20.3 N-m) (Figure 9-1, Page 9-2).

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Golf Cars

Club Car Inc. P.O. Box 204658 Augusta, GA 30917-4658

Club Car

(R)

2000 MAINTENANCE SERVICE SUPPLEMENT

V-GLIDE 36-VOLT VEHICLES

MANUAL NUMBER 102067504 EDITION CODE 0200A00000

FOREWORD

The Club Car V-Glide 36-volt electric vehicle is engineered and built to provide the ultimate in performance efficiency. However, timely and appropriate vehicle maintenance and repair is essential for long-term vehicle performance and continued safe and reliable service.

This supplement provides detailed information for the maintenance and repair of V-Glide 36-Volt electric vehicles and should be used in conjunction with the 2000 DS Golf Car Maintenance and Service Manual, Publication Part No. 102067501. If you do not have a 2000 DS Golf Car Maintenance and Service Manual, you may order one from your local Club Car representative. This supplement and the 2000 DS Golf Car Maintenance and Service Manual should be thoroughly reviewed prior to servicing the vehicle. The procedures provided herein must be properly implemented, and the DANGER, WARNING and CAUTION statements must be heeded.

This supplement was written for the vehicle technician who already possesses knowledge and skills in electrical and mechanical repair. If the mechanic does not have such knowledge and skills, attempted service or repairs to the vehicle may render the vehicle unsafe. For this reason, Club Car advises all repairs and/or service be performed by an authorized Club Car distributor/dealer representative or by a Club Car factory trained technician.

This service supplement, along with the 2000 DS Golf Car Maintenance and Service Manual, covers all aspects of typical service requirements for the V-Glide 36-Volt electric vehicle. If you need additional information, you may write to us at: Club Car, Inc., P.O. Box 204658, Augusta, GA 30917 or contact a Club Car technical service representative at (706) 863-3000, extension 3580.

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A WARNING

- READ SECTION 1-SAFETY IN THE MAINTENANCE AND SERVICE MANUAL BEFORE ATTEMPTING ANY SERVICE ON THIS VEHICLE.
- BEFORE SERVICING VEHICLE, READ COMPLETE SECTION(S) AND ANY REFERENCED INFORMATION RELEVANT TO SERVICE OR REPAIR TO BE PERFORMED.

NOTE

- THIS SUPPLEMENT REPRESENTS THE MOST CURRENT INFORMATION AT THE TIME OF PUBLICATION. CLUB CAR, INC. IS CONTINUALLY WORKING TO IMPROVE OUR VEHICLES AND OTHER PRODUCTS. THESE IMPROVEMENTS MAY AFFECT SERVICING PROCEDURES. ANY MODIFICATION AND/OR SIGNIFICANT CHANGE IN SPECIFICATIONS OR PROCEDURES WILL BE FORWARDED TO ALL CLUB CAR DISTRIBUTORS AND DEALERS AND WILL, WHEN APPLICABLE, APPEAR IN FUTURE EDITIONS OF THIS MANUAL.
- DAMAGE TO A VEHICLE OR COMPONENT THEREOF NOT RESULTING FROM A DEFECT OR WHICH OCCURS DUE TO UNREASONABLE OR UNINTENDED USE, OVERLOADING, ABUSE, OR NEGLECT (INCLUDING FAILURE TO PROVIDE REASONABLE OR NECESSARY MAINTENANCE AS INSTRUCTED IN THE VEHICLE OWNER'S MANUAL), ACCIDENT OR ALTERATION, INCLUDING INCREASING VEHICLE SPEED BEYOND FACTORY SPECIFICATIONS OR MODIFICATIONS WHICH AFFECT THE STABILITY OF THE VEHICLE OR THE OPERATION THEREOF, WILL VOID THE WARRANTY.
- CLUB CAR, INC. RESERVES THE RIGHT TO CHANGE SPECIFICATIONS AND DESIGNS AT ANY TIME WITHOUT NOTICE AND WITHOUT INCURRING ANY OBLIGATION OR LIABILITY WHATSOEVER.
- THERE ARE NO WARRANTIES EXPRESSED OR IMPLIED IN THIS MANUAL. SEE THE LIMITED WARRANTY FOUND IN THE VEHICLE OWNER'S MANUAL OR WRITE TO CLUB CAR, INC.

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SECTION 10-PERIODIC MAINTENANCE

WARNING

- ONLY TRAINED TECHNICIANS SHOULD REPAIR OR SERVICE THIS VEHICLE. ANYONE DOING EVEN SIMPLE REPAIRS OR SERVICE SHOULD HAVE KNOWLEDGE AND EXPERIENCE IN ELECTRICAL AND MECHANICAL REPAIR.
- FOLLOW ALL PROCEDURES EXACTLY AS STATED IN THIS MANUAL, AND HEED ALL DANGER, WARNING AND CAUTION STATEMENTS, AS WELL AS THOSE AFFIXED TO THE VEHICLE.
- CHECK THE VEHICLE OWNER'S MANUAL FOR PROPER LOCATION OF ALL VEHICLE WARNING DECALS AND MAKE SURE THEY ARE IN PLACE AND ARE EASY TO READ.
- IF ANY PROBLEMS ARE FOUND DURING SCHEDULED INSPECTION OR SERVICE, DO NOT OPERATE THE VEHICLE UNTIL REPAIRS ARE MADE. FAILURE TO MAKE NECESSARY REPAIRS COULD RESULT IN FIRE, PROPERTY DAMAGE, SEVERE PERSONAL INJURY, OR DEATH.
- WEAR SAFETY GLASSES OR APPROVED EYE PROTECTION WHILE SERVICING VEHICLE. WEAR A FULL FACE SHIELD WHEN WORKING WITH BATTERIES.
- DO NOT WEAR LOOSE CLOTHING. REMOVE JEWELRY SUCH AS RINGS, WATCHES, CHAINS, ETC. BEFORE SERVICING VEHICLE.
- MOVING PARTS! DO NOT ATTEMPT TO SERVICE THE VEHICLE WHILE IT IS RUNNING.
- HOT! DO NOT ATTEMPT TO SERVICE HOT MOTOR OR RESISTORS. FAILURE TO HEED THIS WARNING COULD RESULT IN SEVERE BURNS.
- USE INSULATED TOOLS WHEN WORKING NEAR BATTERIES OR ELECTRICAL CONNECTIONS. USE EXTREME CAUTION TO AVOID SHORTING OF COMPONENTS OR WIRING.
- TO AVOID UNINTENTIONALLY STARTING THE VEHICLE, DISCONNECT BATTERIES AS SHOWN IN FIGURE 10-2, PAGE 10-3.
- TURN KEY SWITCH TO **OFF**, REMOVE THE KEY, PLACE THE FORWARD/REVERSE HANDLE IN THE **NEUTRAL** POSITION, AND CHOCK WHEELS PRIOR TO SERVICING.
- IMPROPER MAINTENANCE OR USE OF THIS VEHICLE COULD RESULT IN DECREASED VEHICLE PERFORMANCE OR SEVERE PERSONAL INJURY.
- ANY MODIFICATION OR CHANGE TO THE VEHICLE WHICH AFFECTS THE STABILITY OR HANDLING OF THE VEHICLE, OR INCREASES MAXIMUM VEHICLE SPEED BEYOND FACTORY SPECIFICATIONS, COULD RESULT IN SEVERE PERSONAL INJURY OR DEATH.
- LIFT ONLY ONE END OF THE VEHICLE AT A TIME. BEFORE LIFTING, LOCK THE BRAKES AND CHOCK THE WHEELS THAT REMAIN ON THE FLOOR. USE A SUITABLE LIFTING DEVICE (CHAIN HOIST OR HYDRAULIC FLOOR JACK) WITH 1000 LB. (454 KG.) MINIMUM LIFTING CAPACITY. DO NOT USE LIFTING DEVICE TO HOLD VEHICLE IN RAISED POSITION. ALWAYS USE APPROVED JACKSTANDS OF PROPER WEIGHT CAPACITY TO SUPPORT VEHICLE.

GENERAL INFORMATION

To ensure continuing reliable performance of the 36-volt electric vehicle, a Preventive Maintenance program should be established and followed. Preventive Maintenance consists of the regular performance of scheduled vehicle service and maintenance procedures, and is the only way to ensure the vehicle provides the safe, reliable, and economical service it is designed to deliver. The following charts provide recommended service intervals for the lubrication and maintenance of the 36-volt vehicle. Note that critical areas such as brake operation, accelerator operation, steering and tires should be performed daily. These checks can easily be performed when moving the vehicle from the storage facility to the starting line. Any vehicle that is not functioning properly should be removed from service until it has been repaired.

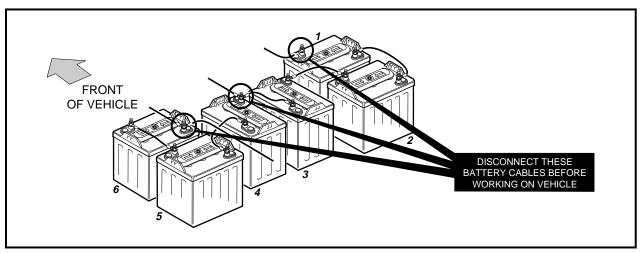


Figure 10-1 V-Glide Battery Configuration

DAILY PRE-OPERATION SAFETY CHECKLIST

Inspect and drive the vehicle, using the Pre-operation Checklist and Performance Inspection in Section 3 in the Maintenance and Service Manual as guides to check the following items.

- Vehicle warning decals
- · Brake system
- · Park brake
- Reverse warning buzzer
- Steering and linkages
- Proper acceleration and maximum speed
- Batteries
- Accelerator Switch

In addition, check the items listed below:

- Tires: Visually inspect for wear, damage and proper inflation.
- Forward/Reverse switch: Check for proper operation. See Controls, Section 3–General Information in the DS Golf Car Maintenance and Service Manual.
- Charger cord, plug and receptacle. See Charger Receptacle, Section 12–Electrical Components, Page 12-15.

PERIODIC SERVICE SCHEDULE

A WARNING

• SERVICE, REPAIRS, AND ADJUSTMENTS MUST BE MADE PER INSTRUCTIONS IN THE MAINTENANCE AND SERVICE MANUAL AND THIS SUPPLEMENT.

NOTE

- IF THE VEHICLE IS CONSTANTLY SUBJECTED TO HEAVY USE OR SEVERE OPERATING CONDITIONS, THE PREVENTIVE MAINTENANCE PROCEDURES SHOULD BE PERFORMED MORE OFTEN THAN RECOMMENDED IN THE PERIODIC SERVICE AND LUBRICATION SCHEDULES.
- BOTH THE PERIODIC SERVICE SCHEDULE AND THE PERIODIC LUBRICATION SCHEDULE MUST BE FOLLOWED TO KEEP THE VEHICLE IN OPTIMUM OPERATING CONDITION.

PERIODIC SERVICE SCHEDULE			
REGULAR INTERVAL	SERVICE		
Daily Service by Owner	Batteries	Charge batteries (after each use only).	
Weekly Service by Owner	Batteries	Check electrolyte level. Add water as necessary per Maintenance and Service Manual.	
	Batteries	Wash battery tops and clean terminals with baking soda/water solution. Dispose of waste water properly .	
Monthly Service by Owner	Tires	Check air pressure and adjust as necessary (See Vehicle Capacities Chart on Page 4).	
Monthly Service by Owner or Trained Technician	Wiper Switch	Check for cracks or other damage; make sure switch is securely fastened to frame. Check movable contact for correct operation.	
	General Vehicle	Wash battery compartment and underside of vehicle. Dispose of waste water properly.	
	Brake System	Check brake shoes; replace if necessary. (See DS Maintenance and Service Manual).	
Cami ammual Camina hu		Lubricate brake slides per Lubrication Schedule. (See DS Maintenance and Service Manual).	
Semi-annual Service by Trained Technician Only		Check brake cables for damage; replace as required.	
(Every 50 hours of operation	Electrical Wiring and connections	Check for tightness and damage.	
or 100 rounds of golf)	Forward and Reverse Switch	Check condition of contacts and wire connections; Make sure connections are tight.	
	Front Wheel Alignment and Camber	Check and adjust as required. (See Maintenance & Service Manual, Section 7).	
	•	·	
Annual Service by Trained Technician Only (Every 100 hours of operation or 200 rounds of golf)	Batteries	If batteries are not performing as expected, refer to Section 13–Batteries.	

WARNING

• IF ANY PROBLEMS ARE FOUND DURING SCHEDULED INSPECTION OR SERVICE, DO NOT OPERATE THE VEHICLE UNTIL REPAIRS ARE MADE. FAILURE TO MAKE NECESSARY REPAIRS COULD RESULT IN FIRE, PROPERTY DAMAGE, SEVERE PERSONAL INJURY, OR DEATH.

LUBRICATION

PERIODIC LUBRICATION SCHEDULE				
REGULAR INTERVAL	SERVICE	PLACE*	RECOMMENDED LUBRICANT	
	Brake pedal shaft bearings	1.	Dry Moly Lube - Club Car Part No. 1012151	
	Brake Linkage and Pivots	2.	Dry Moly Lube - Club Car Part No. 1012151	
Semi-Annually by Owner or Trained Technician (Every 50	Accelerator push rod pivots and mounts	3.	Dry Moly Lube - Club Car Part No. 1012151	
hours of operation or every 100 rounds for golf cars)	Forward/Reverse Switch Contacts and charger receptacle	4.	WD 40	
	Brake Slides	5.	Dry Moly Lube - Club Car Part No. 1012151	
	Front Suspension (5 fittings)	6.	Chassis Lube - EP NLGI Grade 2	
Periodic Lubrication Schedule continued on next page.				

PERIODIC MAINTENANCE Vehicle Capacities

PERIODIC LUBRICATION SCHEDULE			
REGULAR INTERVAL	SERVICE	PLACE*	RECOMMENDED LUBRICANT
Annually by Trained Technician Only (Every 100 hours of operation or 200 rounds of golf)	Check/fill transaxle to plug level	7.	22 oz. (.67 liter) SAE 30 WT.
	Inspect front wheel bearings (Repack as necessary)	8.	Chassis Lube - EP NLGI Grade 2

*See Figure 10-2.

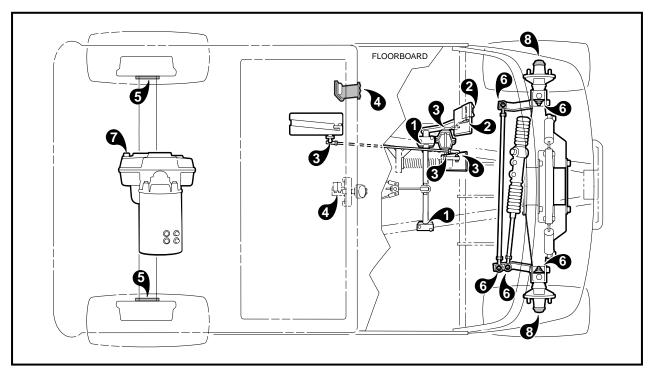


Figure 10-2 V-Glide 36-Volt Vehicle Lubrication Points

VEHICLE CAPACITIES

CAPACITIES	
Transaxle Oil	22 oz. (.67 liters)
Tire Pressure	18-20 psi (124-138 kPa)

SECTION 11-ELECTRICAL SYSTEM AND TESTING

A DANGER

- BATTERY EXPLOSIVE GASES! DO NOT SMOKE. KEEP ALL SPARKS AND FLAMES AWAY. VENTILATE WHEN CHARGING OR USING IN AN ENCLOSED SPACE. ALWAYS WEAR FULL FACE SHIELD AND RUBBER GLOVES WHEN WORKING ON OR NEAR BATTERIES.
- USE EXTREME CAUTION WHEN USING TOOLS, WIRES, OR METAL OBJECTS NEAR BATTERIES! A SHORT CIRCUIT AND (OR) SPARK COULD CAUSE AN EXPLOSION.
- BATTERY POISON! CONTAINS ACID! CAUSES SEVERE BURNS. AVOID CONTACT WITH SKIN, EYES, OR CLOTHING. ANTIDOTES:
 - EXTERNAL: FLUSH WITH WATER, CALL A PHYSICIAN IMMEDIATELY.
 - INTERNAL: DRINK LARGE QUANTITIES OF WATER OR MILK. FOLLOW WITH MILK OF MAGNESIA OR VEGETABLE OIL. CALL A PHYSICIAN IMMEDIATELY.
 - EYES: FLUSH WITH WATER FOR 15 MINUTES. CALL A PHYSICIAN IMMEDIATELY.

A WARNING

- ONLY TRAINED TECHNICIANS SHOULD REPAIR OR SERVICE THIS VEHICLE. ANYONE DOING EVEN SIMPLE REPAIRS OR SERVICE SHOULD HAVE KNOWLEDGE AND EXPERIENCE IN ELECTRICAL AND MECHANICAL REPAIR.
- FOLLOW ALL PROCEDURES EXACTLY AS STATED IN THIS MANUAL, AND HEED ALL DANGER, WARNING AND CAUTION STATEMENTS, AS WELL AS THOSE AFFIXED TO THE VEHICLE.
- WEAR SAFETY GLASSES OR APPROVED EYE PROTECTION WHILE SERVICING VEHICLE.
- TURN KEY SWITCH OFF, PLACE FORWARD/REVERSE HANDLE IN THE NEUTRAL POSITION, AND REMOVE KEY PRIOR TO SERVICING.
- DO NOT WEAR LOOSE CLOTHING. REMOVE JEWELRY SUCH AS RINGS, WATCHES, CHAINS, ETC. BEFORE SERVICING VEHICLE.
- USE INSULATED TOOLS WHEN WORKING NEAR BATTERIES OR ELECTRICAL CONNECTIONS. USE EXTREME CAUTION TO AVOID SHORTING OF COMPONENTS OR WIRING.
- TO AVOID UNINTENTIONALLY STARTING THE VEHICLE, DISCONNECT BATTERIES, NEGATIVE CABLE FIRST, AS SHOWN IN **FIGURE 11-1**, **PAGE 11-1**.

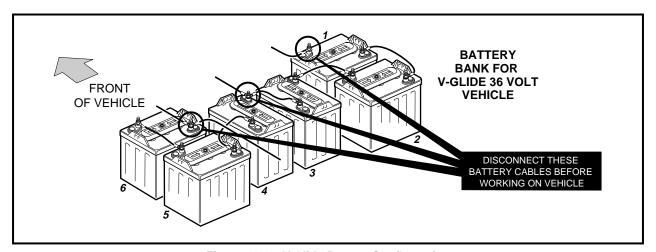


Figure 11-1 V-Glide Battery Configuration

GENERAL INFORMATION

To properly service and maintain the V-Glide 36-volt vehicle, it is necessary to understand the electrical circuitry and the functions of all the electrical components (**Figure 11-3**, **Page 11-4**). On the V-Glide 36-volt vehicle, there are three separate circuits: 1) the control circuit, 2) the power circuit, and 3) the charge circuit. A reverse buzzer is also included on every vehicle.

ELECTRICAL CIRCUITS

THE CONTROL CIRCUIT

The control circuit consists of the key switch, Forward and Reverse (F&R) anti-arcing limit switch, accelerator pedal limit switch, solenoid, and connecting wires.

The key switch has two positions, ON and OFF and is used to disable (open) the control circuit when the vehicle is not in use. With the key in the OFF position, the vehicle will not operate.

The F&R anti-arcing limit switch prevents arcing on the contacts of the F&R switch. When the vehicle is in NEUTRAL, the limit switch is open. The F&R anti-arcing limit switch closes only after full contact has been made on the F&R switch. As the F&R switch is disengaged, the F&R anti-arcing limit switch opens the power circuit by opening the control circuit before the contacts are separated. By using the F&R anti-arcing limit switch to control power to the F&R switch, arcing is prevented on the contacts of the F&R switch.

As the accelerator pedal is depressed, the lever of the accelerator pedal limit switch is released by the V-Glide wiper arm, closing that portion of the control circuit. When the accelerator pedal is fully upright, the V-Glide wiper arm depresses the accelerator pedal limit switch lever and keeps that portion of the control circuit open.

When the accelerator pedal is depressed (which closes the accelerator pedal limit switch) and the Forward/Reverse handle is in FORWARD or REVERSE (which closes F&R anti-arcing limit switch), and key switch is in the ON position, the control circuit is complete. The solenoid coil (enclosed in the solenoid) will then be activated and the solenoid power contacts will close, allowing power to reach the V-Glide wiper switch.

The reverse buzzer is a warning device that is activated when the Forward/Reverse handle is placed in REVERSE. The reverse buzzer will sound continuously until the vehicle is shifted to NEUTRAL or FORWARD.

THE POWER CIRCUIT

The power circuit consists of the V-Glide wiper switch contacts, resistors, F&R switch, solenoid power contacts, motor, batteries, and all connecting wires. The motor and batteries are discussed in separate sections in this manual (Section 15–Motor and Section 13–Batteries).

When the control circuit is closed, the vehicle will start in first speed. As the accelerator pedal is depressed, the brush on the wiper switch arm moves across the contacts until the last contact is reached and full speed is attained. The V-Glide wiper switch brush and contacts conduct the motor current through or around each resistor, thereby controlling the speed (Figure 11-2, Page 11-3).

The F&R switch changes the direction of vehicle movement by changing the direction of electrical current through the motor, and consequently, the direction the motor turns. By limiting maximum voltage available in REVERSE to one-half that available in FORWARD, maximum vehicle speed in REVERSE is limited to one-half the maximum vehicle speed in FORWARD.

THE CHARGE CIRCUIT

The charge circuit consists of the battery charger, charger plug, charger receptacle, onboard fuse link, and the batteries. The batteries and the battery charger are discussed in separate sections in this manual (Section 13–Batteries and Section 14–Accu-Power Battery Charger).

The charger plug and receptacle connection is a critical link between the charger and the vehicle battery circuit. The contacts in the receptacle must grip the plug blades well enough to create enough pressure or drag for an adequate electrical connection. If little or no drag is felt, the receptacle or plug must be replaced. If either the plug or receptacle is damaged or feels hot when charging, one or both must be replaced. **See Section 14–Accu-Power Battery Charger**.

The onboard receptacle fuse link provides additional protection for the vehicle charging circuit. The fuse is rated for use with a Club Car Accu-Power Charger only. If it is blown, the cause should be determined before the fuse is replaced. A vehicle with a blown fuse will not charge. **See Section 14–Accu-Power Battery Charger**.

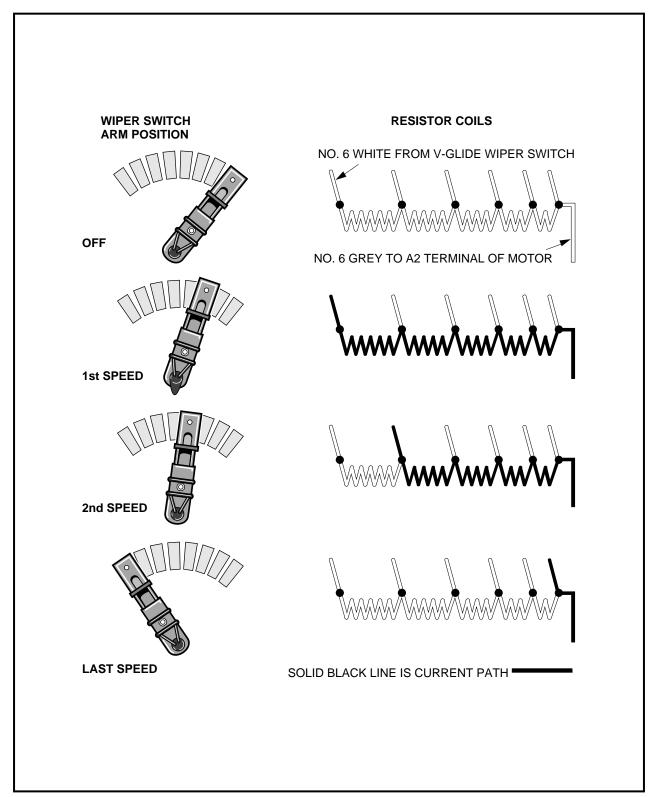


Figure 11-2 Speed Controller

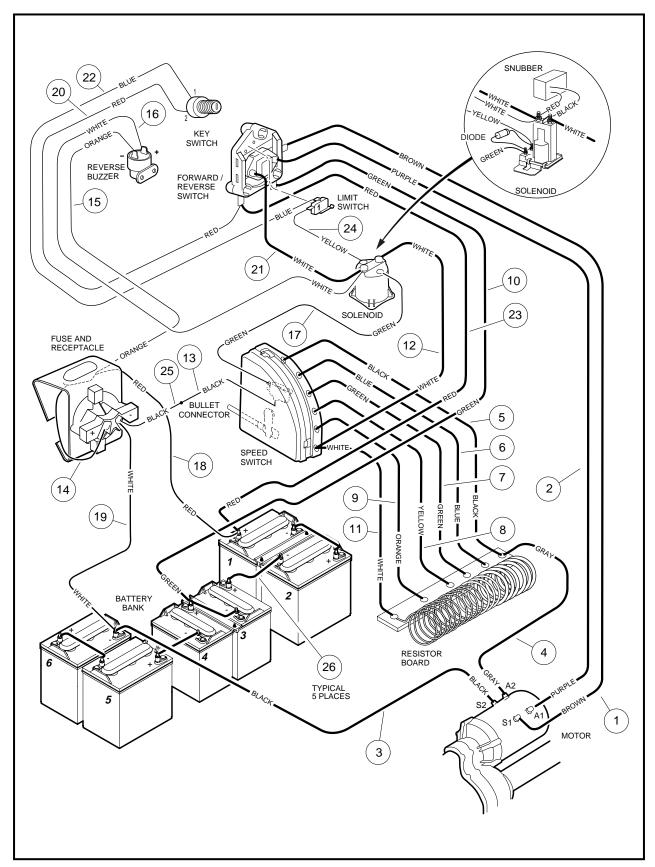


Figure 11-3 Vehicle Wiring Diagram

TROUBLESHOOTING GUIDE

SYMPTOM	PROBLEM		POSSIBLE CAUSES	REFER TO		
Vehicle will not operate - no solenoid click.	Batteries	1)	Battery connections	Test Procedure 1, Page 11-7		
		2)	Batteries discharged	Test Procedure 1, Page 11-7		
	Key Switch	1)	Loose wires	Test Procedure 2, Page 11-7		
		2)	Failed switch	Test Procedure 2, Page 11-8		
	F&R Anti-arching limit switch	1)	Loose wires	Test Procedure 3, Page 11-8		
		2)	Failed Switch	Test Procedure 3, Page 11-8		
		3)	Cam is not activating switch	Test Procedure 3, Page 11-8		
	Accelerator	1)	Accelerator rod disconnected	Accelerator and Brake Pedal, Section 5		
	Accelerator Pedal Limit Switch	1)	Loose wire	Test Procedure 4, Page 11-8		
		2)	Disconnected or improperly connected wires	Test Procedure 4, Page 11-8		
		3)	Failed switch	Test Procedure 4, Page 11-8		
	Solenoid	1)	Loose switch	Test Procedures 10 & 11, Pages 11-13 & 11-13		
		2)	Failed coil	Test Procedure 5, Page 11-9		
Vehicle will not operate - solenoid clicks.	F&R Switch	1)	Loose wires	Test Procedure 8, Page 11-11		
		2)	Failed contacts	Test Procedure 10, Page 11-13		
	Solenoid	1)	Failed contacts	Test Procedure 10, Page 11-13		
	V-Glide Wiper Switch	1)	Loose wires or broken wire connections	Test Procedure 12, Page 11-15		
		2)	Brush or contacts are dirty, burned, corroded, shorted, or worn	Test Procedure 12, see also Electrical Components, Sec- tion 12		
		3)	Improperly wired	Figure 11-3, Page 11-4		
	Motor	1)	Loose wires	Test Procedure 9, Page 11-12		
		2)	Open circuits	Test Procedure 9, see also Motor, Section 15		
		3)	Worn brushes	Test Procedure 9, Page 11-12		
Vehicle skips one or more speeds.	V-Glide Wiper Switch	1)	Loose or broken wire connections	Test Procedure 12, Page 11-15		
		2)	Brush or contacts are dirty, burned, corroded, shorted or worn	Test Procedure 12, see also Electrical Components, Section 12.		
		3)	Improperly wired	Figure 11-3, Page 11-4		
	Resistors	1)	Loose or broken resistor	Test Procedure 7, Page 11-10		
Troubleshooting Guide continued on next page.						

SYMPTOM	PROBLEM		POSSIBLE CAUSES	REFER TO
4. Vehicle operates slowly.	V-Glide Wiper Switch	1)	Poor wire connections	Figure 11-3, Page 11-4
		2)	Dirty or worn contact points	Test Procedure 12, Page 11-15
	Batteries	1)	Loose terminals or corrosion	Test Procedure 1, see also Batteries, Section 13
		2)	Improperly wired	Figure 11-3, Page 11-4
		3)	Batteries failed	See Batteries, Section 13
		4)	Batteries not fully charged	See Charger, Section 14
	Accelerator Push Rod	1)	Accelerator rod is improperly adjusted	V-Glide Wiper Switch, Section 12, Components
	Motor	1)	Loose wire	Test Procedure 9, Page 11-12
		2)	Worn or misaligned brushes	Motor, Section 15
		3)	Dirty or rough commutator	Motor, Section 15
	Brakes	1)	Dragging brakes	Brakes, Section 6, and Accelerator, Section 5
	Tires	1)	Under-inflated or flat tires	Wheels and Tires, Section 8.
5. Vehicle operates in first speed when the F&R switch is placed in Forward or Reverse with the keyswitch OFF.	Solenoid	1)	Solenoid contacts are welded closed	Test Procedure 10, Page 11-13
Vehicle operates in first speed when the F&R switch is placed in Forward or Reverse with keyswitch ON.	Accelerator Pedal Limit Switch	1)	V-Glide Wiper Switch is wired wrong	Accelerator Limit Switch, page 11-2.
		2)	Accelerator Limit Switch failed in the closed position	Test Procedure 4, Page 11-8
	Accelerator Rod	1)	Accelerator Rod is bent or improperly adjusted	Accelerator and Brake Pedal, Section 5.
	V-Glide Wiper Switch	1)	Wiper switch brush or accelerator pedal is stuck	Accelerator and Brake Pedal, Section 5.
		2)	Wiper Switch is improperly adjusted	Accelerator and Brake Pedal, Section 5.
Vehicle will operate in Forward but not in Reverse, or will oper- ate in Reverse but not in For- ward.	F&R Anti-arching Limit Switch	1)	Improper actuation or faulty switch	Test Procedure 3, Page 11-8
	F&R Switch	1)	Dirty or corroded contacts on the F&R switch	Section 12, Electrical Components
	Battery Wires	1)	Improperly wired	Figure 11-3, Page 11-4
Vehicle not being fully charged.	Charger connections	1)	Loose wires at receptacle, batteries or F&R switch	Accu-Power Charger, Section 14
		2)	Improper engagement of charger plug and receptacle	Accu-Power Charger, Section 14
	Onboard receptacle fuse link	1)	Fuse is blown	Accu-Power Charger, Section 14
	Charger	1)	Incorrect incoming AC voltage	Accu-Power Charger, Section 14
		2)	Charger output is low	Accu-Power Charger, Section 14
		3)	Charger cord and plugs	Accu-Power Charger, Section 14

TEST PROCEDURES

Using the following procedures, the entire electrical system of the V-Glide vehicle can be tested without major disassembly; however, a multimeter will be necessary to perform these tests.

A CAUTION

• IF WIRES ARE REMOVED OR REPLACED MAKE SURE WIRING AND/OR WIRING HARNESS IS PROPERLY ROUTED AND SECURED TO VEHICLE FRAME. FAILURE TO PROPERLY ROUTE AND SECURE WIRING COULD RESULT IN VEHICLE MALFUNCTION, PROPERTY DAMAGE OR PERSONAL INJURY.

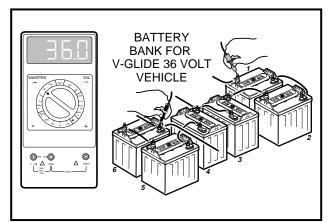
INDEX OF TEST PROCEDURES

- 1. Batteries/Voltage Check
- 2. Key Switch
- 3. Forward and Reverse Anti-Arcing Limit Switch
- 4. Accelerator Pedal Limit Switch
- 5. Solenoid Activating Coil
- 6. Reverse Buzzer
- 7. Resistors
- 8. Forward and Reverse (F&R) Switch
- 9. Motor
- 10. Solenoid Contacts (Power Off)
- 11. Solenoid Contacts (Power On)
- 12. V-Glide Wiper Switch

Test Procedure 1–Batteries/Voltage Check

Read DANGER and WARNING on page 11-1.

 With batteries connected and using a multimeter set to 200 volts DC, place red (+) probe on the positive post of battery No. 1, and black (-) probe on the negative post of battery No. 6 (Figure 11-4, Page 11-7). If multimeter does not indicate at least 36 volts with battery fully charged, check for loose battery connections or a battery installed in reverse polarity. Refer to Section 13-Batteries for further details on battery testing.





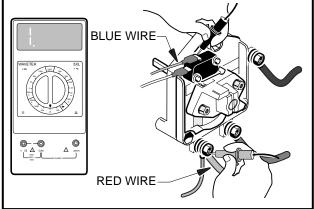


Figure 11-5 Key Switch Test

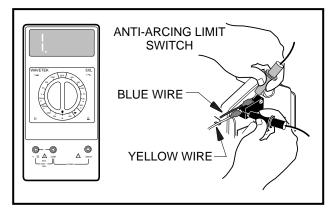
Test Procedure 2–Key Switch

Read DANGER and WARNING on page 11-1.

- With batteries disconnected, place the red (+) probe of a multimeter (set at Ω) on the *forward* terminal of the F&R switch (Figure 11-5, Page 11-7) and place the black (-) probe on the upper (COM) terminal of the F&R anti-arcing limit switch (Figure 11-5, Page 11-7). With the key in the OFF position, the reading should be no continuity.
- 2. Insert the key and turn the key switch to the ON position. The reading should be continuity.
- 3. If the reading is incorrect at either of steps one or two, check the wires and terminals. If no problems are found with the wires or terminals, replace the key switch. **See Section 12–Components**.

Test Procedure 3–Forward and Reverse Anti-Arcing Limit Switch Read DANGER and WARNING on page 11-1.

1. With batteries disconnected, place the red (+) probe of the multimeter (set to Ω) on the common terminal of the limit switch, and place the black (–) probe on the normally open (NO) terminal. The reading should be continuity when the limit switch lever is depressed and no continuity when the lever is released (Figure 11-6, Page 11-8).



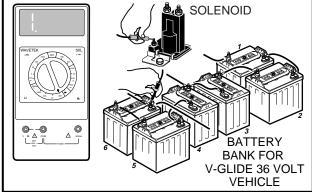


Figure 11-6 F&R Anti-arcing Limit Switch Test

Figure 11-7 Accelerator Pedal Limit Switch Test

If the reading is incorrect at either lever position, replace switch. If readings are correct, check the wires, terminals and cam actuator on the F&R switch rotor. If no problems are found, the problem is not in the switch. See Section 12–Components.

Test Procedure 4–Accelerator Pedal Limit Switch Read DANGER and WARNING on page 11-1.

- With batteries disconnected, place the red (+) probe of the multimeter (set to 200 Ω) on the terminal of the green wire at its connection on the activating coil post of the solenoid, and place the black (–) probe on the negative (–) post of battery number 6 (Figure 11-7, Page 11-8). With the accelerator pedal fully up (not depressed), the reading should be no continuity.
- 2. Depress the accelerator pedal. The reading should be continuity.
- 3. If either reading is incorrect, remove the V-Glide wiper switch housing cover and check for proper activation of the limit switch by the wiper arm.
- 4. Also make sure the 18 gauge green wire is connected to the normally closed (NC) terminal of the limit switch, and the 18 gauge black wire is connected to the common (COM) terminal. There should be no wire attached to the normally open (NO) terminal.

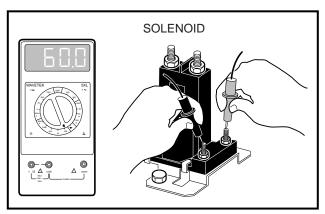


Figure 11-8 Solenoid Activating Coil Test

Test Procedure 5–Solenoid Activating Coil Read DANGER and WARNING on page 11-1.

- 1. With batteries disconnected, place the red probe (+) of the multimeter (set to 200 Ω) on one of the small activating coil posts of the solenoid and place the black (–) probe on the other small post. There should be a reading of 55-60 Ω (ohms) (Figure 11-8, Page 11-9).
- 2. If the reading is incorrect, replace the solenoid.

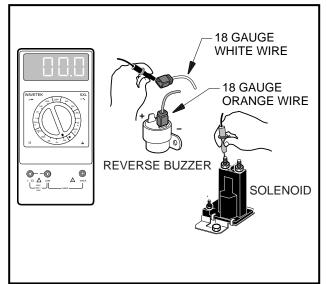
Test Procedure 6–Reverse Buzzer Read DANGER and WARNING on page 11-1.

- 1. Disconnect the batteries, negative cable first (Figure 11-1, Page 11-1).
- 2. Remove the center dash:
 - 2.1. Remove the plastic cap covering the screw on each side of the center dash. Loosen (but do not remove) the screws.
 - 2.2. Insert a flat blade screwdriver at top center of the dash between the dash and the cowl brace. Gently pry the center dash out slightly from under the edge of the cowl brace.
 - 2.3. Pull dash out approximately one inch from the frame and then bend the top right corner of the dash panel inward while pulling the top of the panel out and down. **See following NOTE.**

NOTE

- BENDING THE TOP RIGHT CORNER OF THE CENTER DASH INWARD DURING REMOVAL WILL PREVENT THE CONTACTS ON THE BACK OF THE KEY SWITCH FROM TOUCHING THE METAL FRAME AROUND THE DASH.
- 3. Slide center dash panel up steering column by snapping the top out and then rotating the panel out and up.
- 4. Disconnect the 18 gauge white wire at the reverse buzzer. Place the red (+) probe of a multimeter (set to 200 Ω) on the large post of the solenoid (with the 6 gauge and the 18 gauge white wires attached), and place the black (–) probe on the terminal end of the 18 gauge white wire at the reverse buzzer. The reading should be continuity. If it is not, replace the 18 gauge white wire (Figure 11-9, Page 11-10).
- 5. Disconnect the 18 gauge orange wire at the reverse buzzer. Place the black (–) probe of a multimeter (set to Ω) on the receptacle fuse assembly at the 10 gauge red wire and 18 gauge orange wire connection, and place the red (+) probe on the terminal end of the 18 gauge orange wire at the reverse buzzer. The multimeter should indicate continuity. If not, replace the 18 gauge orange wire (Figure 11-10, Page 11-10).

Test Procedure 6–Reverse Buzzer, Continued:



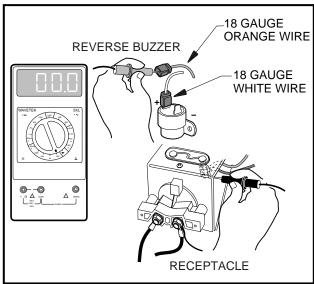


Figure 11-9 Reverse Buzzer Test - White Wire

Figure 11-10 Reverse Buzzer Test - Orange Wire

- 6. If there is continuity in both wires, but the buzzer will not sound, replace the buzzer.
- 7. Reconnect the batteries, positive cable first. Tighten terminal hardware to 110 in-lb (12.4 N-m). Coat terminals with Battery Protector Spray (Club Car Part No. 1014395).

Test Procedure 7–Resistors

Read DANGER and WARNING on page 11-1.

A WARNING

• DO NOT TOUCH HOT RESISTORS! HOT RESISTORS CAN CAUSE SEVERE BURNS.

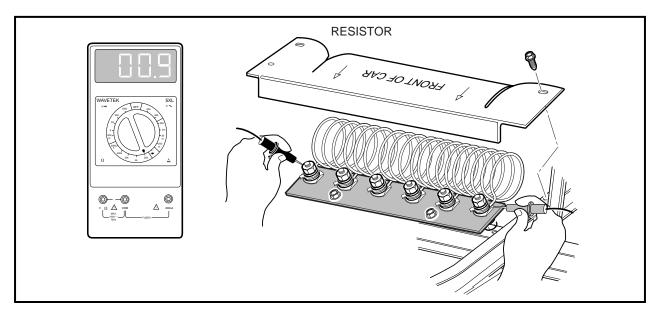


Figure 11-11 Resistor Test

- 1. Inspect the resistors for loose connections, damaged coils or wiring, or problems of any kind.
- 2. If there are no problems, place the red (+) probe of the multimeter (set to 200 Ω) on the first resistor connection, and place the black (–) probe on the last resistor connection. The reading should be continuity or approximately .9 Ω (ohms) (Figure 11-11, Page 11-10).
- 3. If the reading is incorrect, check the resistors again for loose connections or damage. Replace any damaged parts.

Test Procedure 8–Forward and Reverse (F&R) Switch Read DANGER and WARNING on page 11-1.

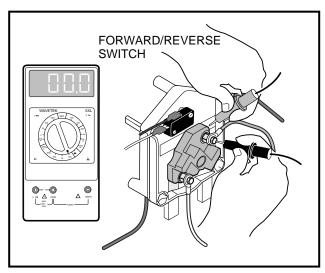


Figure 11-12 F&R Switch Test - Step 1.1

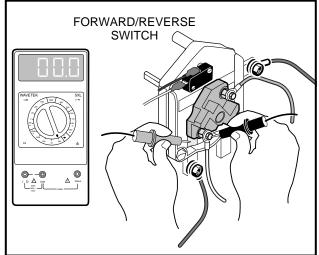


Figure 11-13 F&R Switch Test - Step 1.2

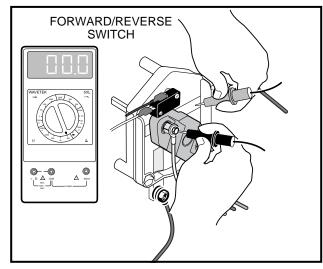


Figure 11-14 F&R Switch Test - Step 1.3

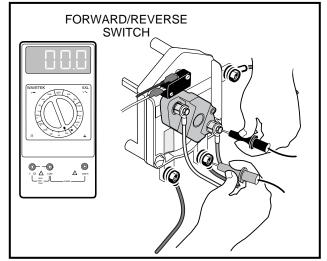


Figure 11-15 F&R Switch Test - Step 1.4

- 1. Disconnect the batteries and use a multimeter (set to 200 Ω) to test the F&R switch in both directions:
 - 1.1. With the F&R switch in the FORWARD position, place the red (+) probe on the common terminal lug of the switch (with brown wire attached), and place the black (-) probe on the movable contact (with the purple wire attached) on the forward and reverse rotor (Figure 11-12, Page 11-11). The reading should be continuity.

- 1.2. With the F&R switch in FORWARD, place the red (+) probe on the forward terminal lug (with the six gauge red wire attached) of the F&R switch, and place the black (-) probe on the movable contact (with the white wire attached) on the forward and reverse rotor (Figure 11-13, Page 11-11). The reading should be continuity.
- 1.3. With the F&R switch in the REVERSE position, place the red (+) probe on the *common* terminal lug (with brown wire attached) of the F&R switch, and place the black (–) probe on the movable contact (with the white wire attached) on the forward and reverse rotor (Figure 11-14, Page 11-11). The reading should be continuity.
- 1.4. With the Forward/Reverse handle in the REVERSE position, place the red (+) probe on the reverse terminal lug of the F&R switch (with green wire attached), and place the black (–) probe on the movable contact (with the purple wire attached) on forward and reverse rotor (Figure 11-15, Page 11-11). Reading should be continuity.
- 2. If the reading is incorrect at any position in Step 1, refer to Section 12-Components.

Test Procedure 9-Motor

Read DANGER and WARNING on page 11-1.

- 1. Disconnect batteries and use a multimeter (set to 200Ω) to test motor armature and motor stator as follows:
 - 1.1. To test the motor armature place the Forward/Reverse handle in the NEUTRAL position, place the red (+) probe on the terminal (with the heavy purple wire attached) on the forward and reverse rotor, and place the black (–) probe on the last resistor coil connection (black and gray wires). The reading should be continuity (Figure 11-17, Page 11-13).
 - 1.2. To test motor stator, place Forward/Reverse handle in the NEUTRAL position, place the red (+) probe on the *common* terminal lug of the F&R switch (brown wire), and place the black (–) probe on the negative post of battery No. 6. The reading should be continuity (Figure 11-18, Page 11-13).
- 2. If either reading in Step 1 is incorrect, check for loose wires or terminals. Then refer to **Section 15–Motor**, for further testing and repair procedures.

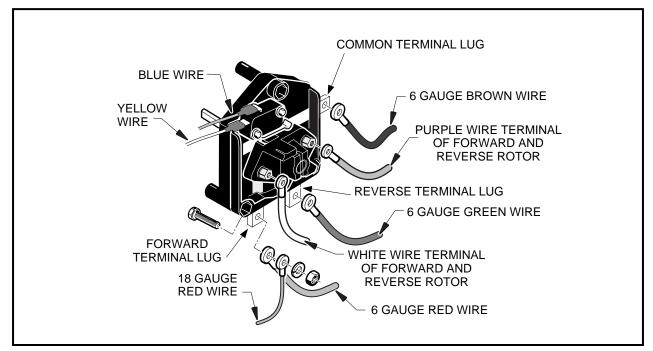
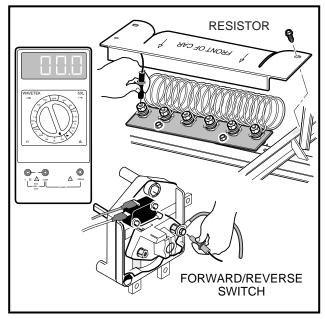


Figure 11-16 F&R Switch



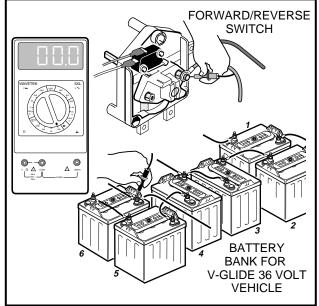


Figure 11-17 Motor Test - Armature

Figure 11-18 Motor Test - Stator

Test Procedure 10-Solenoid Contacts (Power Off) Read DANGER and WARNING on page 11-1.

If the vehicle begins to move as soon as the Forward/Reverse handle is placed in FORWARD or REVERSE, without having depressed the accelerator pedal, the solenoid is probably welded closed. Test the solenoid as follows:

- 1. Heed all WARNING statements. Failure to do so could result in unexpected vehicle acceleration.
- Place the red (+) probe of a multimeter (set at Ω) on one of the large terminal posts on the solenoid, and place the black (–) probe on the other large terminal post on the solenoid. The reading should be *no* continuity (Figure 11-19, Page 11-14).
- 3. If the reading is incorrect, replace the solenoid and snubber. See Section 12-Components.

Test Procedure 11–Solenoid Contacts (Power On) Read DANGER and WARNING on page 11-1.

A DANGER

- BEFORE CONNECTING THE BATTERIES, DISCONNECT THE GRAY WIRE FROM THE RESISTOR BOARD TO THE A2 MOTOR TERMINAL AND REMOVE THE WIRE FROM THE VEHICLE. THEN RAISE THE REAR END OF THE VEHICLE UNTIL THE REAR WHEELS ARE OFF THE FLOOR (SEE WARNING ON PAGE 11-1). WITH THE GRAY WIRE REMOVED, THE SOLENOID CAN BE ACTIVATED WITHOUT SUPPLYING POWER TO THE REAR WHEELS. FAILURE TO DISCONNECT THE GRAY WIRE CAN CAUSE THE VEHICLE TO START ABRUPTLY.
- 1. If the battery cables were disconnected, reconnect them, positive cable first. Tighten terminal hardware to 110 in-lb (12.4 N-m). **See preceding DANGER.**
- 2. With Forward/Reverse handle in NEUTRAL, place red (+) probe of multimeter (set to Ω) on positive post of battery No. 1. Place black (–) probe on the *forward* terminal lug on F&R switch. If reading is no continuity, inspect the wire assembly between these two positions and replace the wire assembly if it is has failed (Figure 11-20, Page 11-14).

Test Procedure 11-Solenoid Contacts (Power On), Continued:

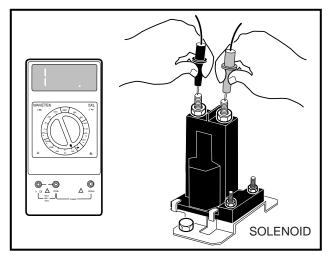
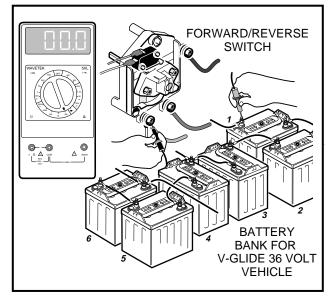


Figure 11-19 Solenoid Contacts - Power Off



SOLENOID

Figure 11-20 Solenoid Contacts - Power On, Step 1

Figure 11-21 Solenoid Contacts - Power On, Step 2

3. With the key switch in the ON position and the Forward/Reverse handle in the FORWARD position, depress the accelerator pedal to the floor (solenoid will click). With the accelerator pedal depressed, place the red (+) probe of a multimeter (set to Ω) on one of the large posts on the solenoid, and place the black (-) probe on the other large post on the solenoid. The multimeter should indicate continuity. If the reading is incorrect, replace the solenoid (Figure 11-21, Page 11-14). See following WARNING.

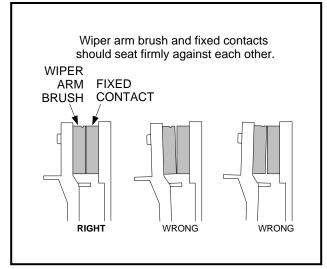
A WARNING

 REMOVE KEY, PLACE FORWARD/REVERSE HANDLE IN NEUTRAL, AND DISCONNECT BATTERIES, NEGATIVE CABLE FIRST, AS SHOWN IN FIGURE 11-1, PAGE 11-1 BEFORE REPLACING SOLENOID OR INSTALLING GRAY WIRE FROM RESISTOR BOARD TO A2 MOTOR TERMINAL.

Test Procedure 12-V-Glide Wiper Switch

Read DANGER and WARNING on page 11-1.

1. Remove the V-Glide wiper switch cover and observe the wiper arm brush as it moves across the fixed contacts. There should be sufficient spring pressure in the arm to keep the wiper arm brush firmly against each of the fixed contacts as it travels across them. There should also be proper surface contact between the brush and each of the fixed contacts as shown (Figure 11-22, Page 11-15).



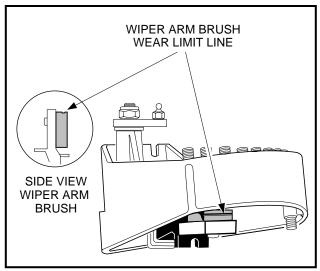


Figure 11-22 Wiper Arm Brush and Fixed Contacts

Figure 11-23 Wiper Arm Brush Wear Limit Line

- Inspect both the brush and fixed contacts for excessive pitting, burns, or wear. If the brush is worn to the wear limit line (Figure 11-23, Page 11-15) it must be replaced. If the brush must be replaced, see Section 12-Electrical Components.
- 3. Make sure all the contacts are tight and the V-Glide wiper switch housing is not melted or burned around the contacts. If the housing or fixed contacts are damaged, the entire wiper switch housing with contacts must be replaced.
- 4. Make sure nuts attaching wires to the backs of the fixed contacts are tightened to 40 in-lb (4.5 N-m).

SECTION 12-ELECTRICAL COMPONENTS

A DANGER

- BATTERY EXPLOSIVE GASES! DO NOT SMOKE. KEEP SPARKS AND FLAMES AWAY. VENTILATE WHEN CHARGING OR USING IN AN ENCLOSED SPACE. ALWAYS WEAR FULL FACE SHIELD AND RUBBER GLOVES WHEN WORKING ON OR NEAR BATTERIES.
- USE EXTREME CAUTION WHEN USING TOOLS, WIRES, OR METAL OBJECTS NEAR BATTERIES! A SHORT CIRCUIT AND (OR) SPARK COULD CAUSE AN EXPLOSION.
- BATTERY POISON! CONTAINS ACID! CAUSES SEVERE BURNS. AVOID CONTACT WITH SKIN, EYES, OR CLOTHING. ANTIDOTES:
 - EXTERNAL: FLUSH WITH WATER. CALL A PHYSICIAN IMMEDIATELY.
 - INTERNAL: DRINK LARGE QUANTITIES OF MILK OR WATER. FOLLOW WITH MILK OF MAGNESIA OR VEGETABLE OIL. CALL A PHYSICIAN IMMEDIATELY.
 - EYES: FLUSH WITH WATER FOR FIFTEEN MINUTES. CALL PHYSICIAN IMMEDIATELY.

A WARNING

- ONLY TRAINED TECHNICIANS SHOULD REPAIR OR SERVICE THIS VEHICLE. ANYONE DOING EVEN SIMPLE REPAIRS OR SERVICE SHOULD HAVE KNOWLEDGE AND EXPERIENCE IN ELECTRICAL AND MECHANICAL REPAIR.
- FOLLOW ALL PROCEDURES EXACTLY AS STATED IN THIS MANUAL, AND HEED ALL DANGER, WARNING AND CAUTION STATEMENTS, AS WELL AS THOSE AFFIXED TO THE VEHICLE.
- WEAR SAFETY GLASSES OR APPROVED EYE PROTECTION WHILE SERVICING VEHICLE.
- DO NOT WEAR LOOSE CLOTHING. REMOVE JEWELRY SUCH AS RINGS, WATCHES, CHAINS, ETC. BEFORE SERVICING VEHICLE.
- USE INSULATED TOOLS WHEN WORKING NEAR BATTERIES OR ELECTRICAL CONNECTIONS. USE EXTREME CAUTION TO AVOID SHORTING OF COMPONENTS OR WIRING.
- TO AVOID UNINTENTIONALLY STARTING THE VEHICLE, DISCONNECT BATTERIES, NEGATIVE CABLE FIRST, AS SHOWN IN FIGURE 12-1, PAGE 12-1 WHEN PERFORMING TESTS THAT DO NOT REQUIRE THE ELECTRICAL SYSTEM TO BE ENERGIZED.

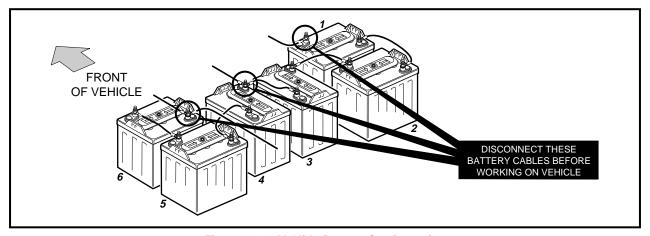


Figure 12-1 V-Glide Battery Configuration

ELECTRICAL COMPONENTS Key Switch

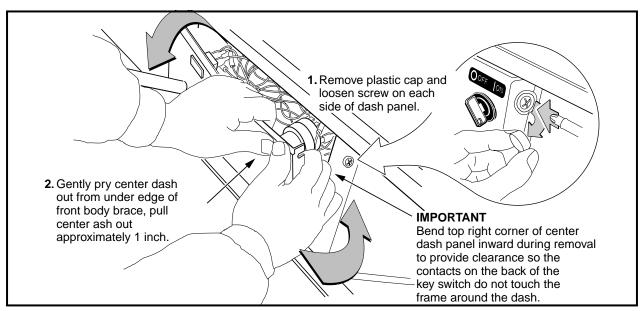


Figure 12-2 Dash Removal

KEY SWITCH

Read DANGER and WARNING on page 12-1.

The key switch is mounted to the right of the steering column on the center dash panel.

Testing the Key Switch

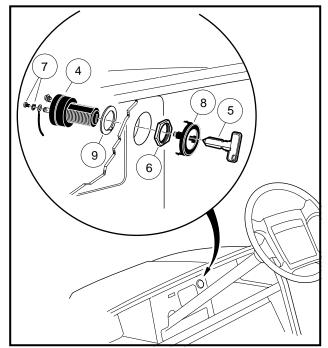
See Section 11, Test Procedure 2, Page 11-8.

Key Switch Removal

- 1. Disconnect the batteries, negative cable first (Figure 12-1, Page 12-1).
- 2. Remove the center dash (Figure 12-2, Page 12-2):
 - 2.1. Remove the plastic cap covering the screw on each side of the center dash. Loosen (but do not remove) the screws.
 - 2.2. Insert a flat blade screwdriver at top center of the dash between the dash and the cowl brace. Gently pry the center dash out slightly from under the edge of the cowl brace.
 - 2.3. Pull dash out approximately one inch from the frame and then bend the top right corner of the dash panel inward while pulling the top of the panel out and down. **See following NOTE.**

NOTE

- BENDING THE TOP RIGHT CORNER OF THE CENTER DASH INWARD DURING REMOVAL WILL PREVENT THE CONTACTS ON THE BACK OF THE KEY SWITCH FROM TOUCHING THE METAL FRAME AROUND THE DASH.
- 3. Slide center dash panel up the steering column by snapping the top out and then rotating the panel out and up.
- 4. Disconnect the wires from the key switch. Do not allow the wires to touch.
- 5. From the back of the dash panel, push down on the retaining tabs surrounding the key switch and remove the key switch cap (8). Hold the key switch and remove the switch retaining nut (6) from the outside of the dash panel (Figure 12-3, Page 12-3).



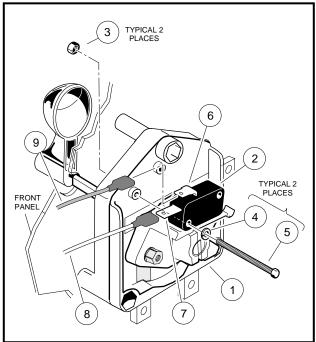


Figure 12-3 Key Switch

Figure 12-4 F&R Anti-arcing Limit Switch

Key Switch Installation

- 1. Position the key switch in the center dash and install the switch retaining nut. Press the plastic cap into place on the outside of the center dash (Figure 12-3, Page 12-3).
- 2. Connect the wires to the key switch terminals (see Section 11, Figure 11-3, Vehicle Wiring Diagram, Page 11-4) and then coat the terminals with Battery Protector Spray (Club Car Part No. 1014305).
- 3. Install the center dash by reversing the removal procedure. Make sure the key switch terminals cannot touch the frame and that the panel is properly seated and snapped into place.
- 4. Reconnect battery cables, positive cable first, and tighten terminal hardware to 110 in-lb (12.4 N-m).

FORWARD/REVERSE (F&R) ANTI-ARCING LIMIT SWITCH

Read DANGER and WARNING on page 12-1.

The F&R Anti-arcing Limit switch is located on the F&R switch and is activated by a cam on the F&R switch rotor.

Testing the Anti-arcing Limit Switch

See Section 11, Test Procedure 3, Page 11-8.

Anti-arcing Limit Switch Removal

1. Remove the nuts, lock washers, and screws attaching the anti-arcing limit switch to the F&R switch (Figure 12-4, Page 12-3).

Anti-arcing Limit Switch Installation

- 1. Position the anti-arcing limit switch (2) on the F&R switch housing and install the screws, lock washers, and nuts. Tighten the screws to 5 in-lb (0.6 N-m) (Figure 12-4, Page 12-3).
- 2. Connect the blue wire (9) to the common (COM) terminal (6) and the yellow wire (8) to the normally open (NO) terminal (7) (Figure 12-4, Page 12-3).

Anti-arcing Limit Switch Installation, Continued:

After installation, make sure the switch makes an audible click (makes and breaks contact) when the forward and reverse rotor is turned. If it does not click, inspect the forward and reverse rotor and limit switch for damage.

ACCELERATOR PEDAL LIMIT SWITCH

Read DANGER and WARNING on page 12-1.

Testing the Accelerator Pedal Limit Switch

See Section 11, Test Procedure 4, Page 11-8.

Accelerator Pedal Limit Switch Removal

- 1. Disconnect battery cables, negative cable first. Remove No. 5 and No. 6 batteries from vehicle (Figure 12-1, Page 12-1).
- 2. Remove the cover (10) from the V-Glide wiper switch housing (1) (Figure 12-10, Page 12-10).
- 3. Disconnect the accelerator rod from the ball stud (5) on the wiper switch (Figure 12-10, Page 12-10).
- 4. Remove and retain the screws (19), lock washers (16), and nuts (22) attaching the limit switch (20) to the wiper switch (Figure 12-10, Page 12-10).
- 5. Disconnect the green (35) and black wires (36) from the limit switch (Figure 12-10, Page 12-10).

Accelerator Pedal Limit Switch Installation

- 1. Position accelerator pedal limit switch (20) on V-Glide wiper switch body and install mounting screws (19), lock washers (16), and nuts (22). Tighten screws to 5 in-lb (0.6 N-m) (Figure 12-10, Page 12-10).
- 2. Connect the accelerator rod ball joint to the ball stud (5) on the wiper switch (Figure 12-10, Page 12-10).
- Connect the green wire (35) to the normally closed (NC) terminal and the black wire (36) to the common (COM) terminal of the limit switch. The normally open (NO) terminal should have *no* wire attached to it (Figure 12-10, Page 12-10).
- 4. Install cover (10) on V-Glide wiper switch (make sure all three tabs snap into place) (Figure 12-10, Page 12-10).
- 5. Install the No. 5 and No. 6 batteries and connect battery cables, positive cable first. Tighten terminal hardware to 110 in-lb (12.4 N-m) (Figure 12-1, Page 12-1).

REVERSE BUZZER

Read DANGER and WARNING on page 12-1.

Testing the Reverse Buzzer

See Section 11, Test Procedure 6, Page 11-9.

Reverse Buzzer Removal

- Disconnect the batteries, negative cable first, (Figure 12-1, Page 12-1) and remove the center dash.
 See Remove Center Dash, Page 12-2.
- 2. Remove the orange and white wires from the buzzer terminals. **See Section 11, Figure 11-3, Vehicle Wiring Diagram, Page 11-4.** Remove the screws attaching the buzzer to the center dash.

Reverse Buzzer Installation

- 1. Install reverse buzzer and center dash by reversing removal procedures. Tighten screws to 4 in-lb (0.45 N-m).
- 2. Reconnect battery cables, positive cable first. Tighten battery hardware to 110 in-lb (12.4 N-m).

THE SOLENOID

Read DANGER and WARNING on page 12-1.

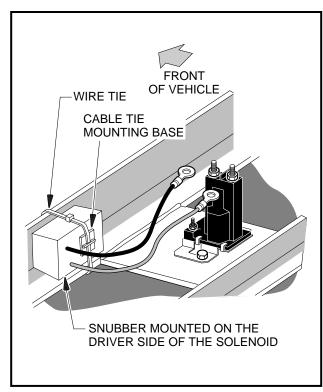
The solenoid is mounted in front of the No. 3 and No. 4 batteries (Figure 12-1, Page 12-1). It has two sets of terminal posts. The two large terminal posts are power contact terminals and the two small posts are activating coil terminals.

Testing the Solenoid

See Section 11, Test Procedure 5, Page 11-7, and Test Procedures 10 and 11, Page 11-10.

Solenoid Removal

- 1. Disconnect battery cables, negative cable first (Figure 12-1, Page 12-1). Disconnect wires from solenoid.
- 2. Remove the two thread rolling screws attaching the solenoid to the vehicle.



TORQUE WRENCH 18 GAUGE YELLOW WIRE DIODE OPEN-END RED WRENCH TERMINAL 18 GAUGE GREEN WIRE **BLACK WIRE** FROM SNUBBER RED WIRE FROM SNUBBER 18 GAUGE WHITE WIRE 6 GALIGE WHITE WIRE FROM F&R SWITCH 6 GAUGE WHITE WIRE FROM SPEED SWITCH

Figure 12-5 Mount Solenoid

Figure 12-6 Connect Solenoid Wires

Solenoid Installation

- 1. Position the solenoid with the small posts toward the front of the vehicle and install one of the mounting screws through the driver side hole on the solenoid base and into the corresponding hole in the mounting plate (Figure 12-5, Page 12-5). Tighten screw to 50 in-lb (7.3 N-m).
- 2. Install passenger side screw and tighten to 50 in-lb (5.6 N-m) (Figure 12-5, Page 12-5).
- 3. Install diode assembly onto small solenoid posts. Make sure the direction of the diode is correct. The red insulated terminal of the diode assembly should be installed on the same post to which the 18 gauge yellow wire is attached, and the clear insulated terminal of the diode assembly should be installed on the same post to which the 18 gauge green wire is attached (Figure 12-6, Page 12-5)

ELECTRICAL COMPONENTS Resistors

Solenoid Installation, Continued:.

A WARNING

- DO NOT DAMAGE SNUBBER WHEN MOUNTING SOLENOID.
- INSTALL BOTH MOUNTING SCREWS. FAILURE TO INSTALL BOTH SCREWS CAN RESULT IN SOLENOID AND ELECTRICAL SYSTEM DAMAGE AND FAILURE.
- 4. Attach snubber assembly to frame on either the passenger or the driver side of the solenoid using a wire tie and cable tie mounting base (Figure 12-5, Page 12-5).
- 5. Attach wiring to solenoid. Connect black wire from snubber to the same large solenoid post to which the 6 gauge white wire (from the speed switch) is attached. Connect red wire from the snubber to the same large post to which the 18 gauge and 6 gauge white wires are attached. **See following CAUTION**.

A CAUTION

- MAKE SURE THE WIRES ARE ROUTED SO THE WIRE FROM THE FORWARD AND REVERSE ROTOR DOES NOT PULL ON OTHER WIRES AS THE FORWARD/REVERSE HANDLE IS SHIFTED.
- 6. Using a low profile wrench to hold the inner nuts on the solenoid posts in place, tighten the outer nuts of the large posts to 100 in-lb (11.3 N-m). Tighten the outer nuts of the small solenoid posts to 4 in-lb (0.5 N-m) (Figure 12-6, Page 12-5). See following WARNING.

WARNING

 FAILURE TO HOLD THE INNER NUTS ON THE SOLENOID POSTS WHILE TIGHTENING THE OUTER NUTS OR NOT TIGHTENING THE OUTER NUTS TO THE PROPER SPECIFICATIONS CAN RESULT IN SOLENOID DAMAGE AND FAILURE.

Solenoid Snubber

The solenoid snubber circuit is an arc suppression device that reduces the amount of sparking created as the solenoid contacts open while under a current load. This device minimizes pitting of the contacts and increases solenoid life. There is no method for troubleshooting the snubber circuit. If the solenoid fails, the snubber should also be replaced.

RESISTORS

Read DANGER and WARNING on page 12-1.

The resistors are attached to the resistor mounting board which is located behind the batteries.

Testing the Resistors

See Section 11, Test Procedure 7, Page 11-8.

Resistor Removal

 Disconnect battery cables, negative cable first (Figure 12-1, Page 12-1). Loosen (do not remove) the nuts (1) that secure the resistors (R1 - R5) to the mounting board and then slide the resistors out from under the washers (3) (Figure 12-7, Page 12-7).

Resistor Installation

Position resistor ends under washers (3) and tighten nuts to 95 in-lb (11 N-m) (Figure 12-7, Page 12-7).
Reconnect battery cables, positive cable first. Tighten terminal hardware to 110 in-lb (12.4 N-m). See following CAUTION and NOTE.

CAUTION

- BE SURE THE MOTOR WIRES ARE SECURED IN WIRE TIES SO THEY CANNOT COME INTO CONTACT WITH THE RESISTORS.
- BE SURE RESISTORS ARE NO CLOSER THAN ONE INCH TO RESISTOR SHIELD. IF RESISTORS ARE CLOSER THAN ONE INCH TO RESISTOR SHIELD, ADJUST THE RESISTORS.
- IF A 3-1/2 HORSEPOWER MOTOR IS BEING USED IN CONJUNCTION WITH A V-GLIDE WIPER SWITCH, THE FOURTH AND FIFTH SPEED RESISTOR COILS MUST BE REPLACED WITH NEW COILS (CLUB CAR PART NOS. 1014654 AND 1014655).

NOTE

- MAKE SURE RESISTOR COILS DO NOT TOUCH EACH OTHER. THE VEHICLE WILL NOT RUN PROPERLY IF ANY COILS ARE TOUCHING.
- MAKE SURE THE RESISTOR COILS ARE INSTALLED IN THE PROPER ORDER (FIGURE 12-7, PAGE 12-7). RESISTOR 1 HAS THE SMALLEST DIAMETER WIRE AND THE GREATEST NUMBER OF COILS. RESISTOR 5 HAS THE LARGEST DIAMETER WIRE AND THE SMALLEST NUMBER OF COILS.

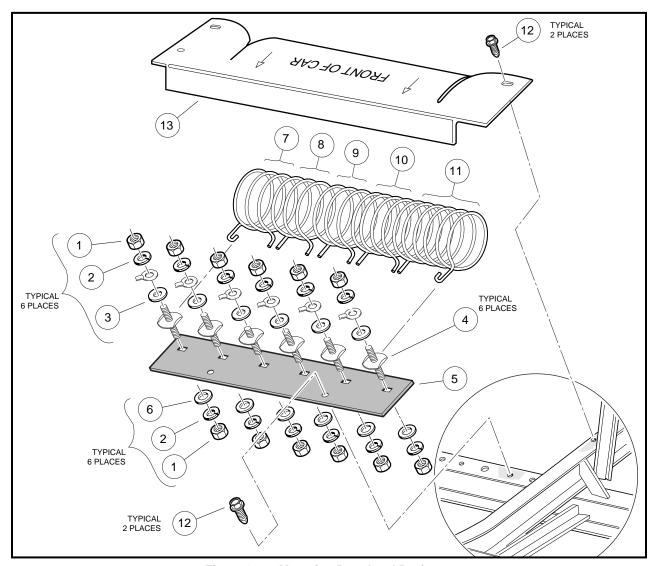


Figure 12-7 Mounting Board and Resistors

ELECTRICAL COMPONENTS Wiper Switch

WIPER SWITCH

Read DANGER and WARNING on page 12-1.

The V-Glide wiper switch is located in the battery compartment next to battery No. 6 (Figure 12-10, Page 12-10). The wiper switch arm adjustment should be checked if the brush on the V-Glide wiper switch is replaced. The pedal group adjustments (see Section 5–Accelerator and Brake Pedal, in the Appropriate Maintenance and Service Manual) should to be checked if any of the pedal group or the accelerator rod has been adjusted, removed, or replaced. See following WARNING.

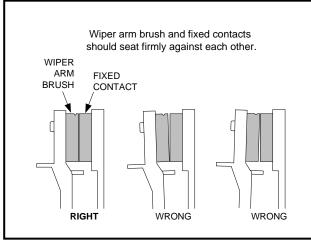
A WARNING

- BE SURE THE V-GLIDE WIPER SWITCH ARM SHAFT ROTATES FREELY IN THE HOUSING. IF THE WIPER SWITCH ARM SHAFT BINDS OR STICKS, IT MUST BE REPLACED.
- MAKE SURE THE V-GLIDE WIPER SWITCH ASSEMBLY IS SECURELY FASTENED TO THE FRAME AFTER INSTALLATION.

The V-Glide wiper switch assembly should be inspected on a monthly basis for cracks or damage and to verify it is securely attached to the vehicle frame.

A CAUTION

- INSPECT THE V-GLIDE WIPER SWITCH HOUSING FOR CRACKS OR DAMAGE BEFORE INSTALLATION. IF THE HOUSING IS CRACKED OR DAMAGED, THE ENTIRE HOUSING WITH FIXED CONTACTS MUST BE REPLACED.
- WHEN WASHING THE VEHICLE, DO NOT DIRECT THE WATER STREAM AT THE WIPER SWITCH.
- DO NOT OPERATE THE VEHICLE WITHOUT THE V-GLIDE WIPER SWITCH COVER IN PLACE.





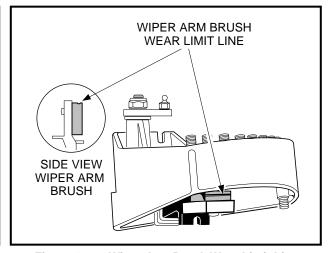


Figure 12-9 Wiper Arm Brush Wear Limit Line

Wiper Switch Arm Adjustment

The contact surfaces on the wiper switch arm brush and the fixed contacts must be parallel to ensure efficient operation of the V-Glide wiper switch (Figure 12-8, Page 12-8). Adjust arm contact as follows:

- 1. Disconnect battery cables, negative cable first. Remove the No. 5 and No. 6 batteries from the vehicle (Figure 12-1, Page 12-1) and remove the cover from the V-Glide wiper switch.
- 2. Test the wiper switch arm and fixed contacts for proper adjustment:
 - 2.1. With a dry erase marker, completely color each of the fixed contacts.

2.2. Sweep the V-Glide wiper switch arm brush back and forth across the fixed contacts. Scraping of the ink should show contact on at least 30% of the surface on each fixed contact. If 30% contact is not shown, surface contact should be adjusted.

To adjust surface contact, turn the adjustment screw (14) (Figure 12-10, Page 12-10) until the surfaces
of the wiper switch arm brush and fixed contacts are parallel (Figure 12-8, Page 12-8). See following
NOTE.

NOTE

- IF THE WIPER SWITCH ARM BRUSH IS WORN TO OR BEYOND THE WEAR LIMIT LINE, IT SHOULD BE REPLACED (FIGURE 12-9, PAGE 12-8). IF ANY OF THE FIXED CONTACTS ARE EXCESSIVELY WORN, PITTED, OR BURNED, THE ENTIRE WIPER SWITCH HOUSING WITH FIXED CONTACTS MUST BE REPLACED.
- A THREAD LOCKING COMPOUND HAS BEEN PLACED ON THE THREADS OF THE CONTACT STUDS TO PREVENT REMOVAL OF THE FIXED CONTACTS.
- 4. Proceed to Wiper Switch Adjustment, Page 12-9.

Wiper Switch Adjustment

Each of the adjustments listed in the following **WARNING** affects V-Glide wiper switch adjustment. To ensure proper vehicle operation, if any one item requires adjustment, all must be checked, and adjusted if necessary, in the order listed.

A WARNING

- TO PROPERLY ADJUST WIPER SWITCH, CHECK, AND ADJUST IF NECESSARY, THE FOLLOWING ITEMS IN THE ORDER LISTED:
 - BRAKE PEDAL AND CABLE ADJUSTMENT. SEE SECTION 5.
 - ACCELERATOR ROD ADJUSTMENT. SEE SECTION 5.
 - ACCELERATOR PEDAL STOP ADJUSTMENT. SEE SECTION 5.
 - PARK BRAKE ADJUSTMENT. SEE SECTION 6.
- FAILURE TO CHECK ALL ADJUSTMENTS IN THE ORDER LISTED COULD RESULT IN IMPROPER VEHICLE OPERATION, PROPERTY DAMAGE, OR SEVERE PERSONAL INJURY.

Wiper Switch Arm Brush Replacement

- 1. Disconnect battery cables, negative cable first. Remove battery Nos. 5 and 6 from the vehicle (Figure 12-1, Page 12-1).
- 2. Disconnect the accelerator rod from the V-Glide wiper switch ball stud (5) and place the wiper switch arm on the topmost fixed contact (Figure 12-10, Page 12-10).
- 3. Remove the cap protector (25), nut (30), and lock washer (31) from the bolt (9) and remove the two 6 gauge white wires (32 and 33) (Figure 12-10, Page 12-10).
- 4. Remove the second nut (3) from the bolt (9) and then remove the bolt from the V-Glide wiper switch housing (1) (Figure 12-10, Page 12-10).
- 5. Remove the third nut (3) and lock washer (23) and wire (34) from the bolt (9) (Figure 12-10, Page 12-10).
- 6. Replace the wiper switch arm brush (18) as follows (Figure 12-10, Page 12-10).
 - 6.1. Remove screw (15), lock washer (16) and pull the arm assembly (17) away from the fixed contacts (Figure 12-10, Page 12-10).
 - 6.2. Remove brush (18) by pulling wire through hole in wiper switch arm (17) (Figure 12-10, Page 12-10).
 - 6.3. Install the new wiper switch arm brush assembly (18) into the wiper switch arm assembly (17) (Figure 12-10, Page 12-10).

Z ELECTRICAL COMPONENTS Wiper Switch

Wiper Switch Arm Brush Replacement, Continued:

6.4. Install the screw (15) and lock washer (16) through the wiper switch arm into the brush. Tighten the screw to 7 in-lb (0.8 N-m).

- 7. Install the arm brush wire terminal (34) onto the bolt (9) and then install the nut (3) and lockwasher (23). Thread the nut against the arm brush wire terminal and tighten it to 40 in-lb (4.5 N-m) (Figure 12-10, Page 12-10).
- 8. Install the bolt (9) through the wiper switch housing (1) and then install the nut (3) onto the bolt. Tighten the nut to 40 in-lb (4.5 N-m) (Figure 12-10, Page 12-10).

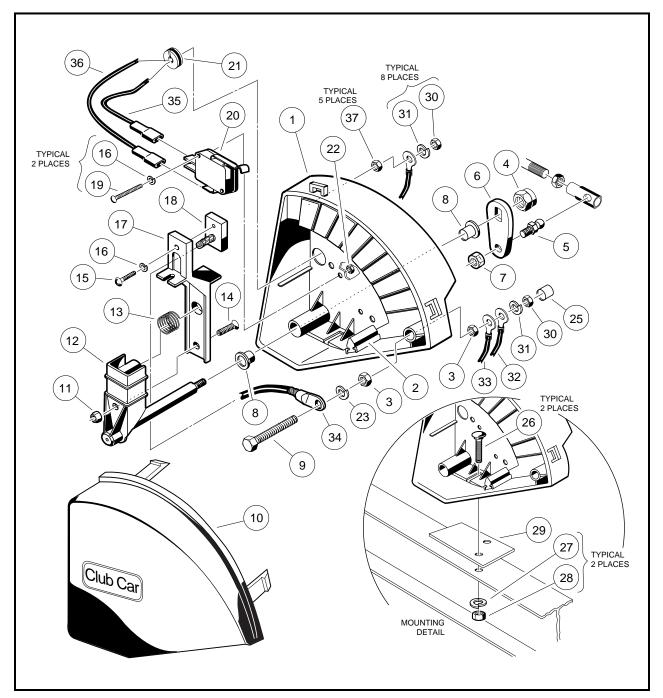


Figure 12-10 V-Glide Wiper Switch

- 9. Install the 6 gauge white wire from the first resistor and the 6 gauge white wire from the solenoid onto the bolt (9), then install the lock washer (31) and nut (30). Tighten nut to 40 in-lb (4.5 N-m) (Figure 12-10, Page 12-10).
- 10. Check wiper switch arm brush contact for proper adjustment. See Wiper Switch Arm Adjustment, Page 12-8.
- 11. Connect the accelerator rod to the V-Glide wiper switch ball stud (5) (Figure 12-10, Page 12-10).
- 12. Install the V-Glide wiper switch cover (10) (Figure 12-10, Page 12-10).
- 13. Install the No. 5 and No. 6 batteries. Reconnect batteries, positive cable first. Tighten terminal hardware to 110 in-lb (12.4 N-m) (Figure 12-1, Page 12-1).

Wiper Switch Removal

- 1. Remove battery Nos. 5 and 6 from the vehicle (Figure 12-1, Page 12-1).
- 2. Remove nuts (30) and lock washers (31), then remove resistor wires from wiper switch (Figure 12-10, Page 12-10).
- 3. Remove the cover (10) from the wiper switch (Figure 12-10, Page 12-10).
- 4. Disconnect the black wire (36) from the charger receptacle (Figure 12-10, Page 12-10).
- 5. Disconnect the green wire (35) from the small post on the solenoid (Figure 12-10, Page 12-10).
- 6. Remove nuts (28) and lock washers (27) securing V-Glide wiper switch to vehicle frame and then remove the wiper switch from vehicle (Figure 12-10, Page 12-10). Re-secure shim (29) to vehicle frame.

Wiper Switch Disassembly

- 1. Remove the nut (3) and slide the bolt (9) out of the wiper switch housing (Figure 12-10, Page 12-10).
- 2. Remove the nut (4) and bell crank (6) (Figure 12-10, Page 12-10).
- 3. Slide wiper switch arm assembly out of the V-Glide wiper switch housing (1) (Figure 12-10, Page 12-10).
- 4. Disassemble the wiper switch arm assembly: Unscrew the adjustment screw (14) and nylon lock nut (11) and remove the spring (13) (Figure 12-10, Page 12-10).
- 5. To remove the bearings (8) (Figure 12-10, Page 12-10) lightly tap them from the back with a punch.

Wiper Switch Assembly

- 1. Install bearings (8) into the wiper switch housing by lightly tapping them with a plastic hammer. Make sure that the collars of the bearings are flush against the wiper switch housing (Figure 12-10, Page 12-10).
- 2. With the spring (13) in place, hold the V-Glide wiper switch arm shaft (17) and carrier (12) together (Figure 12-10, Page 12-10). See following CAUTION.

A CAUTION

- MAKE SURE THE SPRING IS IN THE GROOVE ON THE WIPER SWITCH. IF IT IS NOT IN PLACE, THE WIPER SWITCH ARM MAY BREAK IF FORCED.
- Install the adjustment screw (14) and a new nylon lock nut (11) (Figure 12-10, Page 12-10).

NOTE

- WIPER SWITCH ARM SHOULD BE ADJUSTED AFTER WIPER SWITCH IS FULLY ASSEMBLED.
- 4. Slide the wiper switch arm assembly into the wiper switch housing and install the bell crank with the ball stud down and away from the housing.
- 5. While holding the bell crank so the arm does not exert a load on the wiper switch housing, install the nut (4) and tighten to 9 ft-lb (12 N-m) (Figure 12-10, Page 12-10).

ELECTRICAL COMPONENTS Wiper Switch

Wiper Switch Assembly, Continued:

- 6. If the ball stud (5) was removed, insert it through the bell crank with the ball facing away from the wiper switch housing and install the lock nut (7). While holding the ball stud with a wrench, tighten the lock nut to 5 ft-lb (7 N-m) (Figure 12-10, Page 12-10).
- 7. Install bolt (9) with wire terminal, lock washer, and nut through switch housing (Figure 12-10, Page 12-10).
- 8. Install the nut (3) onto the bolt and tighten to 40 in-lb (4.5 N-m). See following WARNING.

WARNING

- MAKE SURE THE WIPER SWITCH ARM ROTATES FREELY IN THE HOUSING. IF THE ARM BINDS OR STICKS, IT MUST BE REPLACED.
- 9. Adjust the wiper switch. See Wiper Switch Adjustment, Page 12-9.

Wiper Switch Installation

A CAUTION

 BEFORE INSTALLING THE WIPER SWITCH, INSPECT THE HOUSING FOR CRACKS OR DAMAGE. IF THE HOUSING IS DAMAGED, THE ENTIRE HOUSING WITH FIXED CONTACTS MUST BE REPLACED.

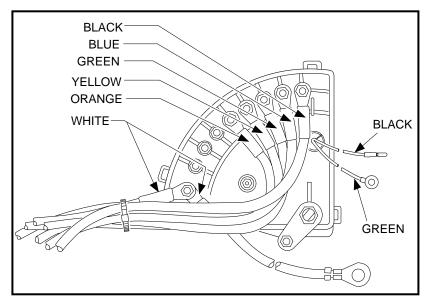


Figure 12-11 V-Glide Wiper Switch Wires

 Position shim plate (29) on I-beam and then place V-Glide wiper switch assembly in position on shim plate. Install mounting bolts (26), lock washers (27) and nuts (28) (Figure 12-10, Page 12-10). Make sure square shoulders on the bolts fit squarely into the wiper switch housing. Tighten nuts to 36 in-lb (4.0 N-m).

A WARNING

- AFTER INSTALLING THE V-GLIDE WIPER SWITCH, MAKE SURE IT IS SECURELY FASTENED TO THE VEHICLE FRAME.
- 2. Install the accelerator rod onto the ball stud.

- 3. Connect 18 gauge green wire from limit switch to the small post on the solenoid that does not have the 18 gauge yellow wire attached. **See Section 11, Figure 11-3, Vehicle Wiring Diagram, Page 11-4**.
- 4. Connect the 18 gauge black wire to black lead from charger receptacle (Figure 12-11, Page 12-12).
- 5. Connect the 6 gauge white wire from the resistor coil and the 6 gauge white wire from the solenoid to the bolt (9) in the wiper switch housing. Install the lock washer (31) and nut (30) onto the bolt and tighten to 40 in-lb (4.5 N-m). Install cap protector (25) (Figure 12-10, Page 12-10).
- 6. Connect the 6 gauge orange wire to the fourth contact from the bottom and tighten the nut to 40 in-lb (4.5 N-m). Please note, the first three contacts have NO wires attached to them.
- 7. Connect the 6 gauge yellow wire to the fifth contact from the bottom and tighten the nut to 40 in-lb (4.5 N-m).
- 8. Connect the 6 gauge green wire to the sixth contact from the bottom and tighten the nut to 40 in-lb (4.5 N-m).
- 9. Connect the 6 gauge blue wire to the seventh contact from the bottom and tighten nut to 40 in-lb (4.5 N-m).
- 10. Connect the 6 gauge black wire to the eighth contact from the bottom and tighten the nut to 40 in-lb (4.5 N-m). **See following WARNING and CAUTION.**

WARNING

• MAKE SURE WIRES ARE CONNECTED TO V-GLIDE WIPER SWITCH CONTACTS EXACTLY AS STATED. IF THEY ARE NOT, THE VEHICLE COULD START IN A SPEED OTHER THAN FIRST.

A CAUTION

- DO NOT OPERATE VEHICLE WITHOUT V-GLIDE WIPER SWITCH COVER IN PLACE. OPERATING VEHICLE WITHOUT THE COVER ALLOWS DIRT, DUST, AND WATER TO CONTAMINATE WIPER SWITCH, WHICH COULD CAUSE SWITCH TO FAIL OR MALFUNCTION.
- 11. Make sure the wiper switch and pedal group are properly adjusted. See Section 5–Accelerator and Brake Pedal in the DS Golf Car Maintenance and Service Manual. See also WARNING on Page 12-9.
- 12. Reconnect battery cables, positive cable first. Tighten terminal hardware to 110 in-lb (12.4 N-m). Drive the vehicle and inspect it for proper operation.

FORWARD/REVERSE (F&R) SWITCH

Read DANGER and WARNING on page 12-1.

The F&R switch is mounted on the front panel of the rear body, in front of the two center batteries.

Testing the F&R Switch

See Section 11, Test Procedure 8, Page 11-11.

F&R Switch Inspection

Visually inspect the forward and reverse movable contact and stationary contacts. Make sure the stationary contacts are in good condition. If they are not, replace the entire forward and reverse assembly. If severe arcing has occurred, check the forward and reverse anti-arcing limit switch for proper operation. Keep the F&R switch clean. If the F&R switch is stiff or binds in operation, lubricate the contact face of the switch with WD-40[®] spray lubricant. See Section 11, Test Procedure 8, Page 11-9. See following WARNING.

WARNING

DO NOT GREASE CONTACTS. THIS COULD CAUSE THE SWITCH TO MALFUNCTION OR BURN.

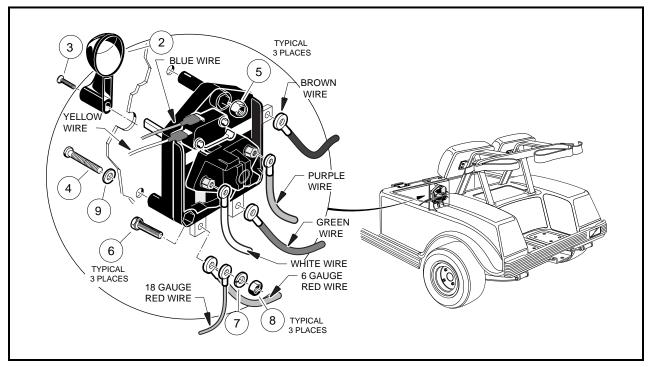


Figure 12-12 Removal and Installation of the F&R Switch

F&R Switch Removal

- 1. Remove F&R handle (2) by removing screw (3) (Figure 12-12, Page 12-14).
- 2. Disconnect the wires from the F&R switch.
- 3. Remove screws (4), washers (9) and nuts (5) that mount F&R switch to the rear body (Figure 12-12, Page 12-14).
- 4. Remove F&R switch.

F&R Switch Installation

1. Connect the wires to the terminal lugs of the F&R switch as shown (Figure 12-12, Page 12-14). Tighten the nuts to 45 in-lb (5.1 N-m). See following NOTE.

NOTE

- MAKE SURE THE 6 GAUGE RED AND GREEN WIRES ARE ANGLED 45° TOWARD THE PASSENGER SIDE OF THE VEHICLE AS SHOWN FIGURE 12-12, PAGE 12-14.
- 2. Secure the F&R switch to rear body. Tighten hardware to 33 in-lb (3.3 N-m) (Figure 12-12, Page 12-14).
- 3. Connect the two 6 gauge wires to the movable contact on the back of the F&R switch. Tighten bolts to 27 in-lb (3.0 N-m) (Figure 12-12, Page 12-14). See following NOTE.

NOTE

- USE A 7/16 INCH WRENCH TO PREVENT MOVABLE CONTACT FROM TURNING.
- 4. Reconnect the 18 gauge wires to the limit switch. See following WARNING.

WARNING

• MAKE SURE WIRES ARE PROPERLY CONNECTED TO F&R SWITCH. IF WIRES ARE NOT PROPERLY CONNECTED, THE VEHICLE MAY OPERATE IN AN UNEXPECTED MANNER, RESULTING IN PROPERTY DAMAGE, SEVERE PERSONAL INJURY OR DEATH.

- 5. Place handle (2) on F&R switch. Tighten screw (3) to 14 in-lb (1.6 N-m) (Figure 12-12, Page 12-14).
- 6. Reconnect battery cables, positive cable first. Tighten terminal hardware to 110 in-lb (12.4 N-m).

CHARGER RECEPTACLE

The charger receptacle and DC cord and plug are wear items that should be inspected daily. They *must* be replaced when worn or damaged. If the charger plug and receptacle show signs of corrosion or are becoming difficult to insert and remove, the receptacle contacts and plug blades can be cleaned with a good electrical contact cleaner or lightly sprayed with WD-40[®] brand spray lubricant.

TESTING THE CHARGER RECEPTACLE

See Section 14, Test Procedure 1, Page 14-7.

CHARGER RECEPTACLE INSPECTION

- 1. Inspect the receptacle for cracks, loose connections and frayed wiring.
- 2. Insert the tapered end of a test blade (Club Car Part No. 1013930) approximately 1-1/2 inch (38 mm) into one side of the receptacle, then withdraw the blade from the contact, pulling straight out from the receptacle.
- 3. Repeat for the other contact. Both contacts must grip the test blade well enough to create sufficient pressure (or drag) for an adequate electrical connection. If little or no drag is felt, the receptacle must be replaced.

Receptacle Removal

A WARNING

- REMOVE KEY AND PLACE FORWARD/REVERSE HANDLE IN THE **NEUTRAL** POSITION.
- DISCONNECT THE BATTERIES AS SHOWN IN FIGURE 12-1, PAGE 12-1.
- 1. Disconnect the small black wire (15) and the white wire (14) (to the negative battery post) from the negative terminal of the receptacle (Figure 12-13, Page 12-16).
- 2. Disconnect the red wire (11) (to the fuse link) from the positive terminal of the receptacle and remove the four screws (1) from the bezel (2) (Figure 12-13, Page 12-16). See following WARNING.

WARNING

- MAKE SURE THE BLACK AND WHITE WIRES DO NOT TOUCH.
- 3. Remove screws (3 and 18) attaching receptacle to the fuse link bracket (4) (Figure 12-13, Page 12-16)

Receptacle Installation

- 1. Install the screws (3 and 18) which attach the receptacle (13) to the fuse link bracket (4) (Figure 12-13, Page 12-16). Tighten the screws to 20 in-lb (2.2 N-m).
- 2. Install red wire of fuse link to positive (+) terminal of receptacle (the positive (+) and negative (–) terminals are labeled on face of receptacle) (Figure 12-13, Page 12-16). Tighten nut to 23 in-lb (2.6 N-m)

2 ELECTRICAL COMPONENTS Charger Receptacle

Receptacle Installation, Continued: .

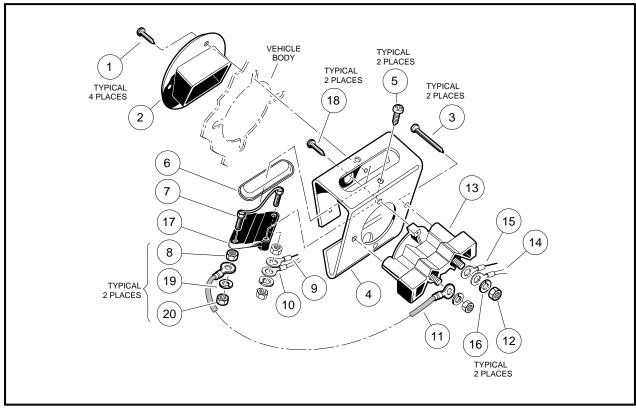


Figure 12-13 Receptacle

- 3. Install the small black wire (from wiper switch) and the white wire (from negative battery post) on the negative (–) terminal of the receptacle (Figure 12-13, Page 12-16). Tighten nut to 23 in-lb (2.6 N-m).
- 4. Position bezel (2) and fuse link bracket (4) and install the four mounting screws (1) through the bezel and into the fuse link bracket (Figure 12-13, Page 12-16). Tighten the screws to 20 in-lb (2.2 N-m).

ONBOARD RECEPTACLE FUSE LINK

If the receptacle fuse link has failed, the vehicle cannot be charged until the fuse has been replaced. The fuse link (7) is located on the fuse link bracket (4) in the battery compartment (rear portion of the charger receptacle) (Figure 12-13, Page 12-16). See also Figure 14-4, in Section 14 on Page 14-3.

WARNING

• UNDER NORMAL OPERATING CONDITIONS, THE RECEPTACLE FUSE LINK SHOULD NEVER FAIL UNLESS THERE IS AN ELECTRICAL PROBLEM. IF THE FUSE BLOWS, DETERMINE THE CAUSE OF THE PROBLEM AND CORRECT IT BEFORE REPLACING THE FUSE.

Receptacle Fuse Link Removal

- 1. Remove the two screws (5) and then the lens (6) (Figure 12-13, Page 12-16).
- 2. Remove the outer nuts (20), lockwashers (19), and wires (9, 10, and 11) (Figure 12-13, Page 12-16).
- 3. Remove the remaining nuts (8) (Figure 12-13, Page 12-16).
- 4. Remove the fuse link (7) from the base (17) (Figure 12-13, Page 12-16).

Receptacle Fuse Link Installation

- 1. Install a new fuse link (7) (Club Car Part No. 1014516) into the base (17) (Figure 12-13, Page 12-16).
- 2. Install nuts (8) which attach fuse link to base and tighten to 18 in-lb (2.0 N-m) (Figure 12-13, Page 12-16).
- 3. Connect the red wire (9) (from the forward and reverse switch) and the orange wire (10) (from the reverse buzzer) to the passenger side of the fuse assembly and install the lock washer (19) and outer nut (20). Tighten the nut to 23 in-lb. (2.5 N-m) (Figure 12-13, Page 12-16). See also Figure 14-4, in Section 14 on Page 14-3.
- 4. Connect the red wire (11) (from the charger receptacle) to the driver's side of the fuse assembly and install the lock washer (19) and nut (20). Tighten the nut to 23 in-lb (2.5 N-m).
- 5. Install fuse link assembly and cover (6). Tighten screws (5) to 20 in-lb (2.2 N-m) (Figure 12-13, Page 12-16).

SECTION 13-BATTERIES

A DANGER

- BATTERY EXPLOSIVE GASES! DO NOT SMOKE. KEEP SPARKS AND FLAMES AWAY. VENTILATE WHEN CHARGING OR USING IN AN ENCLOSED SPACE. ALWAYS WEAR FULL FACE SHIELD AND RUBBER GLOVES WHEN WORKING ON OR NEAR BATTERIES.
- USE EXTREME CAUTION WHEN USING TOOLS, WIRES, OR METAL OBJECTS NEAR BATTERIES! A SHORT CIRCUIT AND (OR) SPARK COULD CAUSE AN EXPLOSION.
- BATTERY POISON! CONTAINS ACID! CAUSES SEVERE BURNS. AVOID CONTACT WITH SKIN, EYES, OR CLOTHING. ANTIDOTES:
 - EXTERNAL: FLUSH WITH WATER. CALL A PHYSICIAN IMMEDIATELY.
 - INTERNAL: DRINK LARGE QUANTITIES OF MILK OR WATER. FOLLOW WITH MILK OF MAGNESIA OR VEGETABLE OIL. CALL A PHYSICIAN IMMEDIATELY.
 - EYES: FLUSH WITH WATER FOR FIFTEEN MINUTES. CALL PHYSICIAN IMMEDIATELY.

WARNING

- ONLY TRAINED TECHNICIANS SHOULD REPAIR OR SERVICE THIS VEHICLE. ANYONE DOING EVEN SIMPLE REPAIRS OR SERVICE SHOULD HAVE KNOWLEDGE AND EXPERIENCE IN ELECTRICAL AND MECHANICAL REPAIR.
- FOLLOW ALL PROCEDURES EXACTLY AS STATED IN THIS MANUAL, AND HEED ALL DANGER, WARNING AND CAUTION STATEMENTS, AS WELL AS THOSE AFFIXED TO THE VEHICLE.
- WEAR SAFETY GLASSES OR APPROVED EYE PROTECTION WHILE SERVICING VEHICLE.
- TURN KEY SWITCH **OFF**, PLACE FORWARD/REVERSE HANDLE IN THE **NEUTRAL** POSITION, AND REMOVE KEY PRIOR TO SERVICING.
- DO NOT WEAR LOOSE CLOTHING. REMOVE JEWELRY SUCH AS RINGS, WATCHES, CHAINS, ETC. BEFORE SERVICING VEHICLE.
- USE INSULATED TOOLS WHEN WORKING NEAR BATTERIES OR ELECTRICAL CONNECTIONS. USE EXTREME CAUTION TO AVOID SHORTING OF COMPONENTS OR WIRING.
- TO AVOID UNINTENTIONALLY STARTING THE VEHICLE, DISCONNECT BATTERIES, NEGATIVE CABLE FIRST, AS SHOWN IN **FIGURE 13-5**, **PAGE 13-4**.

GENERAL INFORMATION

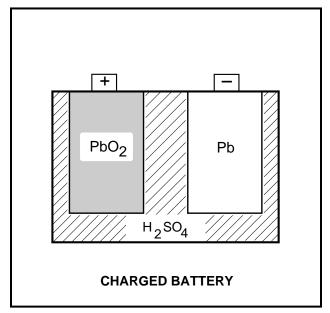
The batteries supplied with a V-Glide 36-volt vehicle are different from those supplied with an automobile. The outward appearance of these two batteries is similar, but the operating characteristics are very different. The V-Glide 36-volt vehicle battery is a deep-cycle battery, and the automotive battery is known as a "starting, lighting and ignition" (SLI) battery. They should never be substituted for one another.

An automotive battery has to deliver high-cranking currents of 300-400 amperes at a sufficient voltage for several seconds and maintain an accessory load of 10-25 amperes in stop-and-go driving. The energy removed from an automotive battery is immediately replaced by the alternator or generator. As a result, the automotive battery operates at 90 to 100% of full charge at all times.

The batteries supplied with an electric vehicle must supply 100% of the energy required to operate the vehicle. These batteries therefore, receive a deep discharge down to 30% to 40% of their full charge capacity. Then they must be recharged, hence the name "deep-cycle." The average amperage draw is considered to be 75 amps, although it varies greatly depending on the vehicle and how it is operated. V-Glide 36-volt batteries are specifically designed to handle this type of service.

13 BATTERIES General Information

General Information, Continued:



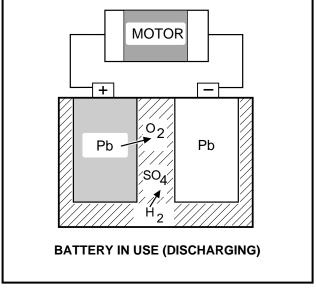


Figure 13-1 Charged Battery

Figure 13-2 Discharging Battery

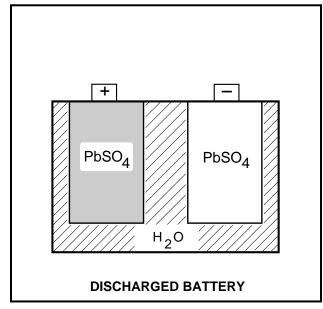


Figure 13-3 Discharged Battery

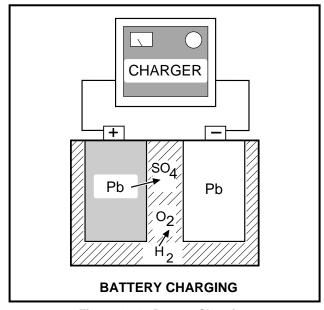


Figure 13-4 Battery Charging

The rechargeable lead-acid battery turns chemical energy into electrical energy and vice versa. The main active elements within a battery are the positive plates, the negative plates and the electrolyte (sulfuric acid). Another very important element (but inactive) is the separator. The separator does exactly what its name implies - it separates the material of the positive and negative plates and prevents them from touching each other, which would create electrical short circuits. The separator is porous enough to allow charged ions to pass between the positive and negative plates, but not allow the two materials to contact each other.

Whenever two unlike metals are immersed in an acid solution, an electric current is generated. In a deep-cycle battery, the negative plates contain lead (Pb) and the positive plates contain lead dioxide (PbO₂). These plates are immersed in a sulfuric acid solution (H_2SO_4) (Figure 13-1, Page 13-2).

During discharge, the chemical reaction inside the battery causes the sulfate (SO_4) to break away from the H_2 (Figure 13-2, Page 13-2).

The sulfate (SO₄) combines with the lead (Pb) on both plates, forming lead sulfate (PbSO₄). Oxygen (O₂) from the positive plates combines with the hydrogen (H) from the electrolyte to form water (H₂O) (Figure 13-3, Page 13-2).

The result is two similar metals, lead sulfate (PbSO₄), immersed in water (H₂O). This will not generate electricity because the battery is completely discharged.

When a discharged battery is connected to a charger, the process is reversed. The sulfate (SO₄) is forced from the plates back into the electrolyte to make sulfuric acid (H₂SO₄). The oxygen returns to the positive plate to make lead dioxide (PbO₂) (Figure 13-4, Page 13-2).

The result is a charged battery that is again capable of generating electricity (Figure 13-1, Page 13-2).

COMMON MISCONCEPTIONS ABOUT BATTERIES

The chart below describes some of the more common misconceptions that are associated with the V-Glide 36-volt battery set and battery care.

	PROBLEM	MISCONCEPTION AND REALITY
1.	Deep-Discharge	Misconception- "This vehicle is running slowly, but we can run it until it stops." Reality- This statement is wrong. Avoid deep discharge of batteries whenever possible. See Deep-Discharge, Page 13-7.
2.	Early Excessive Discharging	Misconception- "These are new batteries. They can run all day." Reality- This statement is wrong also. New batteries do not reach their full capacity until they have been used and recharged 20 to 50 times. See Early Excessive Discharging, Page 13-7.
3.	Mineral Content	Misconception- "Tap water will do for our batteries." Reality- Your tap water might be OK, but have it checked first. See Mineral Content, Page 13-6
4.	Self-Discharge	Misconception- "Dirt and corrosion on the battery won't hurt anything." Reality- Wrong again. Dirt and corrosion might provide a path for current to flow and allow the batteries to self-discharge. See Self-Discharge, Page 13-5.
5.	Overwatering	Misconception- "Batteries can be filled to the level indicator at night, so it won't have to be done in the morning." Reality- Under most circumstances, water should be added after charging. See Electrolyte Level, Page 13-5.
6.	Underwatering	Misconception- "Checking the water takes too much time; it can be checked once a month." Reality- Insufficient watering can ruin batteries. Water level should be checked weekly. See Electrolyte Level, Page 13-5.
7.	Vibration Damage	Misconception- "You should tighten battery hold-downs as tight as you can." Reality- Battery hold-downs should be tightened to specification. Hold-downs that are too tight or too loose can cause battery damage. See Vibration Damage, Page 13-6.

BATTERIES Replacing Batteries

REPLACING BATTERIES

Read DANGER and WARNING on page 13-1.

A WARNING

- TO PREVENT ELECTROLYTE LEAKAGE FROM THE BATTERY VENTS, BATTERIES MUST BE KEPT IN AN UPRIGHT POSITION. TIPPING A BATTERY BEYOND A 45° ANGLE IN ANY DIRECTION CAN ALLOW A SMALL AMOUNT OF ELECTROLYTE TO LEAK OUT THE VENT HOLE. DO NOT EXCEED THIS 45° ANGLE WHEN LIFTING, CARRYING, OR INSTALLING BATTERIES. BATTERY ACID CAN CAUSE SEVERE PERSONAL INJURY TO SKIN OR EYES, AND CAN DAMAGE CLOTHING.
- Before removing batteries, note the orientation of the batteries and the connecting wires. Disconnect
 the batteries, negative cable first. Then remove remaining wires and batteries. See Figure 13-5, Page
 13-4 for V-Glide 36-volt vehicle battery wiring.
- 2. Visually inspect the new batteries for any damage that may have occurred in transit.
- 3. If the battery cables are to be reused, inspect them for broken or frayed wires, damaged terminals, or worn insulation. Remove any corrosion on the connectors. One cup of bicarbonate of soda (baking soda) in a gallon of water and a bristle brush do an excellent job of neutralizing and removing the corrosion. Be careful not to allow the baking soda solution to enter the battery.

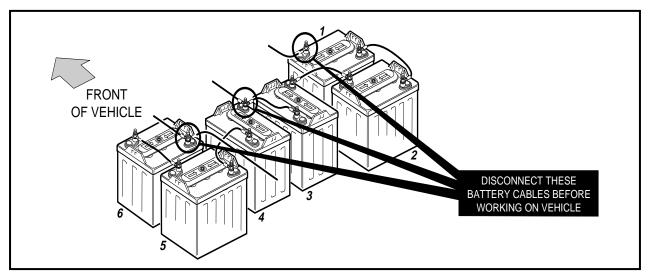


Figure 13-5 V-Glide 36-volt Battery Configuration

- 4. Check and clean the battery rack and hold-downs. The nuts and bolts on the hold-downs may corrode. It is therefore advised that they be cleaned periodically and replaced as necessary.
- 5. Install batteries in the proper orientation (Figure 13-5, Page 13-4). Install battery hold-downs. The hold-downs should be tight enough so batteries do not move while vehicle is in motion, but not so tight as to crack or buckle battery case. Tighten to 40 in-lb (4.5 N-m), alternating between hold-down bolts.
- 6. Install wires in proper sequence (Figure 13-5, Page 13-4). See also Section 11, Page 11-3, Vehicle Wiring Diagram. Install black wire to negative post of battery No. 6 last. Make sure all connections are tight. Tighten to 110 in-lb (12.4 N-m). Coat all terminals with Battery Protector Spray (Club Car Part No.1014305) to minimize future corrosion.
- 7. Give the batteries a full charge prior to operation. This ensures all the batteries are fully charged and the cells are equalized prior to use.

Read DANGER and WARNING on page 13-1.

PREVENTIVE MAINTENANCE

To keep batteries in sound operating condition, follow these steps on a regular basis.

 Any corrosion build-up on or around batteries should be removed immediately. Terminal connections should be clean and tight. Any frayed or worn wires should be replaced. After all cables have been connected, coat all terminals with Battery Protector Spray (Club Car Part No.1014305) to help prevent future corrosion.

- 2. Batteries should be kept clean and dry to prevent self-discharge. Any dirt, grime or acid spillage should be removed. Wash batteries with a bristle brush using water and bicarbonate of soda (baking soda 1 cup per gallon of water). Rinse with water. Do not allow solution to enter battery through the vent cap holes. **See Self-Discharge below.**
- 3. Maintain proper electrolyte level. See Electrolyte Level below.
- 4. Batteries should be properly charged every day they are used. Check the batteries periodically to see that they are in a full state of charge. **See Battery Charging, Page 13-6.**
- 5. Keep hold-downs tight. See Vibration Damage, Page 13-6.

SELF-DISCHARGE

Dirty batteries can provide a path for a small current draw that can slowly discharge batteries, thus wasting valuable energy. To prevent self-discharge, batteries should always be kept clean.

Hot weather also has an effect on a battery's self-discharge rate. The higher the temperature, the quicker a set of batteries will discharge. In hotter climates, batteries should be checked more often. When storing batteries, keep in a cool place. **See Battery Storage**, page 13-13.

ELECTROLYTE LEVEL

A CAUTION

 DO NOT ALLOW BATTERY ACID FROM BATTERY CAPS OR HYDROMETER TO DRIP ONTO THE FRONT OR REAR BODY OF THE VEHICLE. BATTERY ACID WILL CAUSE PERMANENT DAMAGE. WASH OFF IMMEDIATELY.

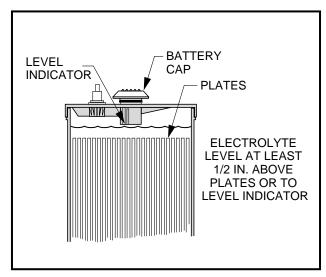


Figure 13-6 Battery Electrolyte Level

BATTERIES Battery Charging

Electrolyte Level, Continued:

Add water only after charging unless the electrolyte is below the level of the plates. If the electrolyte level is below the level of the plates, add just enough water to cover the plates and then charge the batteries. After charging, fill with water to the level indicator. Filling a battery to the level indicator before charging will result in overfilling because the electrolyte level will rise during charging and some of the electrolyte may bubble out of the cap. This reduces the battery's capacity and corrodes the metal parts around it.

The electrolyte level should be checked weekly to be sure electrolyte is at its proper level (Figure 13-6, Page 13-5). Never allow the electrolyte level to fall below the tops of the plates because this will cause the exposed part of the plate to become permanently inactive. For best results, use a battery watering gun to add water to batteries. Check the electrolyte level more frequently in hot weather or when batteries are old.

Mineral Content

For the longest battery life, use distilled water in batteries. However, if tap water is to be used, be sure the mineral contents are below these levels:

IMPURITY	ALLOWABLE CONTENT IN PARTS PER MILLION			
Suspended Matter	Trace			
Total Solids	100.00			
Calcium and Magnesium Oxides	40.0			
Iron	5.0			
Ammonia	8.0			
Organic Matter	50.0			
Nitrates	10.0			
Nitrites	5.0			
Chloride	5.0			
Contact your local water department for this analysis.				

VIBRATION DAMAGE

The battery hold-downs should always be tight enough to keep the battery from bouncing. Battery life may be severely shortened if the battery hold-downs are too loose. Battery hold-downs should be tightened to 40 in-lb (4.5 N-m). Excessive vibration causes the plates to shed prematurely and shortens the life of the battery. It may also cause acid to leak out of the vent caps and corrosion to build up on surrounding metal parts. The acid which is lost reduces the capacity of the battery and cannot be replaced. Battery hold-downs should NOT be so tight as to crack or buckle the battery case. This may cause leaks which would dry out a cell or cause internal short circuits. **See Replacing Batteries, Page 13-4**.

BATTERY CHARGING

Read DANGER and WARNING on page 13-1.

General Information

The charger supplied with the V-Glide 36-volt electric vehicle resolves the most common problems associated with battery charging. Undercharging and overcharging are prevented provided the charger is allowed to shut off by itself. Also, all cells are automatically given an equalization charge at low current, which prolongs battery life. Batteries should never be left in a discharged state as this too affects the internal compo-

nents and can reduce the capacity of the battery. The batteries should be charged every day they are used, even if only for ten minutes or after nine holes. However, the batteries should not be charged if they have not been used. If running 36 holes per day, it is recommended to put the vehicles on charge after the first 18 holes. Even if the charger is only on for an hour or two, it will prevent the batteries from being deeply discharged. If a charger is still on in the morning and it becomes necessary to send the vehicle out before charging is complete, be sure the vehicle gets a catch-up charge sometime during operation. As soon as practical, this vehicle must get a full charge.

CHARGER DOES NOT SHUT OFF AUTOMATICALLY

This may be due to one of the following factors:

- 1. New batteries
- 2. Hard use
- 3. Cold temperatures
- 4. Short charging times (e.g., in late at night, out early in the morning)

A catch-up charge may be necessary when these conditions are present. On an off day, when all or some of the vehicles are not in use, check the batteries in the vehicles for state of charge. Any batteries with a specific gravity lower than 1.250 need a catch-up charge. If the problem continues after a catch-up charge has been performed, refer to **Section 14–Accu-Power Battery Charger**.

DEEP-DISCHARGE

Never discharge a vehicle's batteries to the point the vehicle will no longer operate. This will considerably shorten the cycle life of the batteries, and may permanently damage the batteries. It is possible the batteries will not accept a charge if they are completely discharged. The deeper the discharge, the harder it is on the batteries. For this reason, it is recommended that vehicles be charged after each use. Placing the batteries on charge after each use reduces the depth of discharge and prolongs battery life.

EARLY EXCESSIVE DISCHARGING

When vehicle batteries are new, they do not reach their full capacity until they have been used and recharged 20 to 50 times. If they are excessively discharged early in their life, their effective service life will be shortened. It is advisable to limit the use of any vehicle with new batteries to 18 holes for at least the first four weeks and then gradually increase their range.

INCOMING AC SERVICE

Make sure the incoming AC line service is sufficient. If circuit breakers are tripping, fuses blow during the night or the charger does not give the required starting rate when sound batteries are put on charge, an AC line problem exists. The electrical service to the vehicle storage facility should be sufficient to deliver adequate voltage and current to each charger with all the chargers turned on. If not, consult your local power company or electrical contractor. **See Section 14–Battery Charger.**

FLEET ROTATION

Rotate vehicle usage. Use different vehicles first each morning. It is very hard on batteries if the last vehicles in at night are the first ones out in the morning. Spread the workload evenly, giving all vehicles the same amount of use. This will keep your fleet in balance and will not overwork certain sets of batteries.

NUMBERING VEHICLES AND CHARGERS

Return the vehicles to the same charger each night if possible. If the vehicles are put in a storage facility at random and a vehicle dies while in use and testing shows the batteries are sound, then the problem is most likely with the charger. However, finding the problem charger may prove to be quite time consuming. Numbering the vehicles and the chargers and returning each vehicle to its designated charger each night can significantly reduce the amount of time spent troubleshooting a problem.

BATTERIES Battery Charging

BATTERY TROUBLESHOOTING CHART

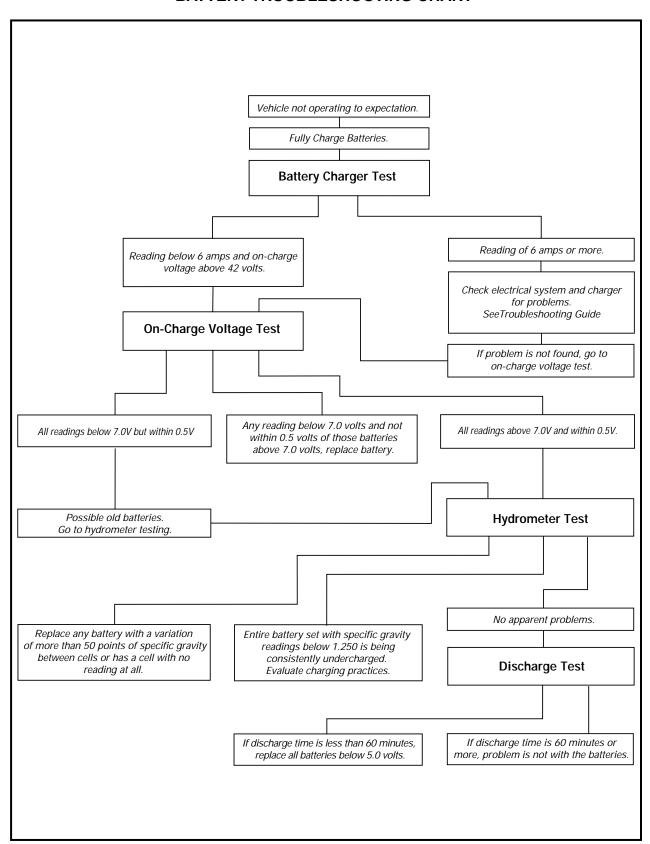


Figure 13-7 Battery Troubleshooting Flow Chart

BATTERY TESTING

Read DANGER and WARNING on page 13-1.

The following four tests have been developed to help diagnose problems with batteries that have not performed as expected. Because each test becomes progressively more detailed and time-consuming, begin with the first test and follow through with the other tests until the problem has been identified as outlined in the Battery Troubleshooting Chart (Figure 13-7, Page 13-8).

BATTERY CHARGER TEST

The easiest way to monitor the condition of a vehicle's batteries is simply to observe the reading on the battery charger ammeter at the end of the charge cycle. After a full charge, disconnect and reconnect the charger DC plug. The ammeter needle will jump to 15 amps or more and then taper to below 6 amps within 10 to 20 minutes, indicating sound, fully charged batteries.

Continued poor performance may indicate a problem in the vehicle electrical system, brakes or battery charger. If the problem is not found in the vehicle or charging system, proceed to the on-charge voltage test. Batteries that remain at 8 amps or higher should be tested further using the on-charge voltage test.

ON-CHARGE VOLTAGE TEST

When batteries are fully charged, disconnect and reconnect charger DC plug to restart the charger. After 5 minutes, record the voltage of the battery set as well as the individual batteries, using a multimeter. Set the meter on 200 volts DC. Place the red (+) probe at the positive terminal and the black (–) probe at the negative terminal of each battery. Record reading. The on-charge voltage for the set should read between 42.0 volts and 47.4 volts depending on the make, size and age of the battery being tested. If individual batteries read above 7.0 volts and are within 0.5 volts of each other, go to hydrometer test. If any battery reads below 7.0 volts and not within 0.5 volts of those batteries above 7.0 volts, replace battery. If readings are below 7.4 volts but within 0.5 volts of each other, the batteries are old. However, they may have enough capacity left to last several more months. Go to hydrometer test. See Troubleshooting Chart, Figure 13-7 and the examples on the following pages.

HYDROMETER TEST

A hydrometer measures the specific gravity of the battery electrolyte. The higher the specific gravity, the higher the state of charge of the batteries. A fully charged battery should read between 1.250 and 1.280 at 80°F (26.7° C). Never add acid to batteries to obtain a higher specific gravity.

Performing the Hydrometer Test

- 1. Be sure batteries have sufficient electrolyte to cover the plates by approximately 1/2 inch and are fully charged prior to beginning test. If water must be added, recharge the batteries before performing the hydrometer test.
- 2. Remove the vent cap. Using a battery thermometer (Club Car part No.1011767), record the electrolyte temperature of the No. 2 cell.
- 3. Squeeze the rubber bulb of the hydrometer and insert into the cell. Slowly release the bulb, drawing electrolyte up into the glass tube of the hydrometer.
- 4. When the float rises off the bottom, adjust the electrolyte level so the float rides free of the bottom but does not strike the top of the glass tube. Remove the hydrometer from the cell and release the pressure from the bulb.
- 5. Hold the hydrometer vertically, making sure the float is not touching the sides of the barrel. Hold the hydrometer at eye level and read the scale at the level of electrolyte (Figure 13-8, Page 13-10).
- 6. Record the reading. Return the electrolyte to the cell from which it was taken. Replace vent cap.
- 7. Repeat steps 2 through 6 on all cells.

BATTERIES Battery Testing

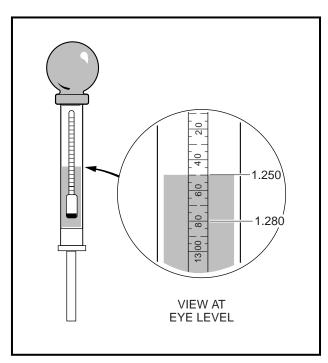


Figure 13-8 Hydrometer

Hydrometer Calibration

Most hydrometers are calibrated to read correctly at 80°F (26.7°C). The readings obtained as described above must be corrected for temperature. For each 10°F (5.6°C) above 80°F (26.7°C), add .004 to the reading. For each 10°F (5.6°C) below 80°F (26.7°C), subtract .004 from the reading.

Interpreting the Results of the Hydrometer Test

The approximate state of charge can be determined from the following table:

SPECIFIC GRAVITY AT 80° (26.7°C)	STATE OF CHARGE
1.250 - 1.280	100%
1.220 - 1.240	75%
1.190 - 1.210	50%
1.160 - 1.180	25%

If the difference between the cells is .020 or more, the low cell should be suspected. It may require a catchup charge or it may be a weak cell. When the variations between cells reach .050 or more, the battery with the low cell should be replaced.

CAR	BATTERY	ELECTROLYTE	CORRECTION	COR	REOUIRED		
NO.	NO.	TEMP.	FACTOR	POSITIVE CELL	CENTER CELL	NEGATIVE CELL	ACTION
12	1	20°F (-6.6°C)	024	1.275024=1.251	1.280024=1.256	1.280024=1.256	Sound Battery- Fully Charged
35	6	90°F (32.2°C)	+.004	1.155+.004=1.159	1.165+.004=1.169	1.160+.004=1.164	Discharged Battery- Recharge
54	3	50°F (10°C)	012	1.260012=1.248	1.200012=1.188	1.270012=1.258	Bad Center Cell

CAR	BATTERY	ELECTROLYTE	CORRECTION	COR	REOUIRED		
NO.	NO.	TEMP.	FACTOR	POSITIVE CELL	CENTER CELL	NEGATIVE CELL	ACTION
69	5	80°F (26.7°C)	.000	1.250-0=1.250	1.255-0=1.255	1.230-0=1.230	Weak Negative Cell- Catch-up Charge
38	2	100°F (37.8°C)	+.008	1.200+.008=1.208	1.180+.008=1.188	1.170+.008=1.178	Discharged Battery- Recharge and Recheck
22	4	80°F (26.7°C)	.000	1.240-0=1.240	1.245-0=1.245	Float Does Not Rise	Negative Cell Dead- Replace Battery

DISCHARGE TEST

If the previous tests have failed to identify the problem, conduct a discharge test. The discharge test comes closest to simulating actual vehicle operating conditions by continuously drawing current from the batteries until voltage drops to 31.5 volts.

The discharge test is the hardest test on the batteries and the most time-consuming to perform. Use the battery discharge tester (Club Car Part No.101831901).

Performing the Discharge Test

- 1. Be sure the batteries are fully charged and that the electrolyte level is correct in all cells.
- 2. Connect the tester leads to the positive (+) post of battery No.1 and negative (-) post of battery No. 6 (Figure 13-9, Page 13-11).

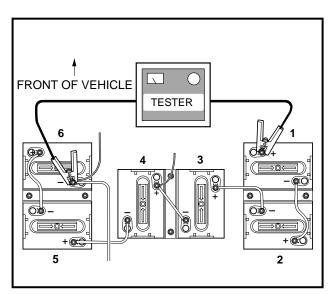


Figure 13-9 Discharge Test

- 3. Check and record the electrolyte temperature of the battery packs. Check center cell of each battery.
- 4. Reset discharge machine (or reset timer if using older discharge machine with 36-volt vehicle).
- 5. Turn the tester ON.
- 6. When the batteries have been discharging for approximately 60 minutes, set the discharge machine to function 3 and check battery set voltage. Check voltage every 10 minutes throughout the rest of the test. As soon as the battery set voltage reaches .50 volts above the shut-off point (31.5 volts), use a multimeter to measure individual battery voltages. Measure and record the voltage of each battery to the nearest .01 volt.

BATTERIES Battery Testing

NOTE

• THE TESTER WILL TURN OFF AUTOMATICALLY WHEN SHUT-OFF VOLTAGE IS REACHED.

Interpreting Discharge Test Results

- 1. If discharge time is 60 minutes or higher, the problem is not with the batteries.
- 2. If discharge times are low (less than 60 minutes), replace all batteries below 5.0 volts.

BATTERY VOLTAGES						
1	2	3	4	5	6	BATTERY CONDITION
5.25	5.25	5.25	5.25	5.25	5.25	EXCELLENT
5.3	5.3	5.4	4.9	5.3	5.3	BATTERY NO. 4 IS NEAR END OF USEFUL LIFE
5.4	5.4	5.0	5.5	4.7	5.5	BATTERY NOS. 3 AND 5 ARE NEAR END OF USEFUL LIFE

3. In general, cars that discharge in less than 60 minutes at 78°F (25.6°C) on the discharge test will not normally make 36 holes. However, discharge time is dependent on the electrolyte temperature. The table shown gives the discharge times at various temperatures of a set of batteries that delivers 62 minutes at 80°F.

ELECTROLYTE TEMP. °F (°C)	DISCHARGE TIME TO SHUT-OFF POINT	ELECTROLYTE TEMP. °F (°C)	DISCHARGE TIME TO SHUT-OFF POINT
40 - 49 (4.4 - 9.4)	40 Minutes	85 - 89 (29.4 - 31.7)	64 Minutes
50 - 59 (10 - 15)	45 Minutes	89 - 99 (31.7 - 37.2)	66 Minutes
60 - 64 (15.6 - 17.8)	50 Minutes	100 - 109 (37.8 - 42.8)	68 Minutes
65 - 69 (18.3 - 20.6)	54 Minutes	110 - 119 (43.3 - 48.3)	70 Minutes
70 - 74 (21.1 - 23.3)	57 Minutes	120 - 129 (48.9 - 53.9)	72 Minutes
75 - 79 (23.9 - 26.1)	60 Minutes	130 - 150 (54.4 - 65.6)	74 Minutes
80 - 84 (26.7 - 28.9)	62 Minutes		

BATTERY TROUBLESHOOTING EXAMPLES

The following information represents a few examples of troubleshooting battery problems.

Example 1

Vehicle No. 68 was suspected of having a bad battery due to its performance. As a result, the battery charger test was performed. After a full charge, the battery charger ammeter read 8.0 amps. Next, the on-charge voltage test was performed and the following results were recorded:

Example 1, Continued:

BATTERY NO.	1	2	3	4	5	6
ON-CHARGE VOLTAGE	7.61	7.95	7.36*	7.62	7.92	7.96

^{*}Battery No. 3 appears suspect. Battery Nos. 1 and 4 are also suspect. Next, a hydrometer test should be conducted on all batteries.

Hydrometer test results:

BATTERY NO.	1	2	3	4	5	6
			SPECIFIC	GRAVITY		
POSITIVE POST CELL	1.200*	1.265	1.300	1.250	1.280	1.260
CENTER CELL	1.285	1.275	1.290	1.270	1.295	1.265
NEGATIVE POST CELL	1.275	1.270	1.285	1.265	1.275	1.275

^{*}After the hydrometer test, it appears that battery No. 1 is the problem. Next, the discharge test was performed.

Discharge test results:

BATTERY NO.	1	2	3	4	5	6
DISCHARGE VOLTAGE	4.08*	5.50	5.80	5.36	5.57	5.56

^{*}After a discharge test which lasted 45 minutes, battery No. 1 is clearly shown to be the problem. Battery No. 4 should be watched a little more closely but appears to be okay. Battery No. 1 should be replaced with a battery that has about the same age and usage as the other batteries in the set.

Example 2

Vehicle No. 70 was also suspected of having a bad battery due to its performance. The battery charger test showed 7.0 amps after a full charge. After confirming there were no problems with the electrical system, charger or brakes, the on-charge voltage was recorded as follows:

BATTERY NO.	1	2	3	4	5	6
ON-CHARGE VOLTAGE	7.86	7.33*	7.90	7.93	7.91	7.75

^{*}Battery No. 2 was immediately suspected as the problem. After checking the No. 2 battery with a hydrometer, it was discovered the negative post cell was completely dead. Battery No. 2 should be replaced with a battery that has the same age and usage as the other batteries in the set.

BATTERY STORAGE

Read DANGER and WARNING on page 13-1.

When storing batteries during the off-season or when maintaining a replacement stock, follow these guidelines.

- 1. Keep the batteries clean and free of corrosion as outlined in the Battery Care section. See Battery Care, Page 13-5.
- 2. Batteries can be left connected for winter storage.

Battery Storage, Continued:

- 3. Fully charge the batteries prior to storage.
- 4. Store in a cool area. The colder the area in which the batteries are stored, the less the batteries will self-discharge. Batteries stored at 0°F (-17.8°C) will discharge very little over a four-month period. Batteries stored at 80°F (26.7°C) will have to be recharged every few weeks.
- 5. Check the state of charge periodically. Batteries that are discharged and left in a cold environment can freeze and crack. If the specific gravity drops below 1.220, the batteries should be recharged. See the following chart.

SPECIFIC GRAVITY	FREEZING POINT
1.260	-70°F (-56.7°C)
1.230	-39°F (-39.4°C)
1.200	-16°F (-26.7°C)
1.170	-2°F (-18.9°C)
1.110	+17°F (-8.3°C)

6. The frequency of recharging required will depend on the temperature of the storage area, but it is recommended the batteries be monitored for state of charge every month. Also, if the storage area is unheated in a cold climate and recharge is required, it is recommended the area be heated to at least 60°F (15.6°C) prior to charge. Batteries do not charge effectively in cold temperatures for the same reasons they do not discharge as rapidly in cold temperatures.

CHARGING A BATTERY PACK THAT HAS LOW VOLTAGE

See Section 14–Accu-Power Battery Charger.

SECTION 14-ACCU-POWER BATTERY CHARGER

A DANGER

- BATTERY EXPLOSIVE GASES! DO NOT SMOKE. KEEP SPARKS AND FLAMES AWAY. VENTILATE WHEN CHARGING OR USING IN AN ENCLOSED SPACE. ALWAYS WEAR FULL FACE SHIELD AND RUBBER GLOVES WHEN WORKING ON OR NEAR BATTERIES.
- USE EXTREME CAUTION WHEN USING TOOLS, WIRES, OR METAL OBJECTS NEAR BATTERIES! A SHORT CIRCUIT AND (OR) SPARK COULD CAUSE AN EXPLOSION.
- BATTERY POISON! CONTAINS ACID! CAUSES SEVERE BURNS. AVOID CONTACT WITH SKIN, EYES, OR CLOTHING. ANTIDOTES:
 - EXTERNAL: FLUSH WITH WATER. CALL A PHYSICIAN IMMEDIATELY.
 - INTERNAL: DRINK LARGE QUANTITIES OF MILK OR WATER. FOLLOW WITH MILK OF MAGNESIA OR VEGETABLE OIL. CALL A PHYSICIAN IMMEDIATELY.
 - EYES: FLUSH WITH WATER FOR FIFTEEN MINUTES. CALL PHYSICIAN IMMEDIATELY.

A WARNING

- ONLY TRAINED TECHNICIANS SHOULD REPAIR OR SERVICE THIS VEHICLE. ANYONE DOING EVEN SIMPLE REPAIRS OR SERVICE SHOULD HAVE KNOWLEDGE AND EXPERIENCE IN ELECTRICAL AND MECHANICAL REPAIR.
- FOLLOW ALL PROCEDURES EXACTLY AS STATED IN THIS MANUAL, AND HEED ALL DANGER, WARNING AND CAUTION STATEMENTS, AS WELL AS THOSE AFFIXED TO THE VEHICLE.
- WEAR SAFETY GLASSES OR APPROVED EYE PROTECTION WHILE SERVICING VEHICLE.
- TURN KEY SWITCH **OFF**, PLACE FORWARD/REVERSE HANDLE IN THE **NEUTRAL** POSITION, AND REMOVE KEY PRIOR TO SERVICING.
- DO NOT WEAR LOOSE CLOTHING. REMOVE JEWELRY SUCH AS RINGS, WATCHES, CHAINS, ETC. BEFORE SERVICING VEHICLE.
- USE INSULATED TOOLS WHEN WORKING NEAR BATTERIES OR ELECTRICAL CONNECTIONS. USE EXTREME CAUTION TO AVOID SHORTING OF COMPONENTS OR WIRING.
- DISCONNECT THE ELECTRICAL CORDS BEFORE ATTEMPTING ANY REPAIR TO THE CHARGER. FIRST DISCONNECT THE AC CORD FROM THE OUTLET AND THEN DISCONNECT THE DC CORD FROM THE VEHICLE.
- TO AVOID UNINTENTIONALLY STARTING THE VEHICLE, DISCONNECT BATTERIES, NEGATIVE CABLE FIRST, AS SHOWN IN **FIGURE 14-4, PAGE 14-3**.

GENERAL INFORMATION

Each Club Car V-Glide 36-volt electric vehicle is equipped with a fully automatic Accu-Power battery charger. There are no knobs to turn or buttons to push. The charger will turn on two to five seconds after it is plugged in, and it will automatically turn off when the batteries are fully charged. The charger automatically compensates for a variable AC voltage supply between 105 to 128 volts and then tapers the charge rate for longer battery life. Charging time depends on the age of the batteries and on the amount of use they have experienced. The charger compensates for these factors by measuring the voltage increase versus time, and turns off when the batteries are fully charged. As long as the charger is allowed to turn OFF by itself, overcharging and undercharging should be prevented (Figure 14-1). See following WARNING and CAUTION.

General Information, Continued:

A WARNING

• BECOME FAMILIAR WITH WIRING AND TERMINOLOGY OF CHARGER BEFORE ATTEMPTING ANY REPAIR TO THE CHARGER (FIGURE 14-2, PAGE 14-2 AND FIGURE 14-3, PAGE 14-3).

A CAUTION

• DO NOT LEAVE THE DC CORD PLUGGED INTO A VEHICLE RECEPTACLE WHILE UNATTENDED FOR MORE THAN TWO DAYS IN A ROW. SEVERE OVERHEATING AND DAMAGE TO THE BATTERIES MAY RESULT IF THE CHARGER DOES NOT TURN OFF.

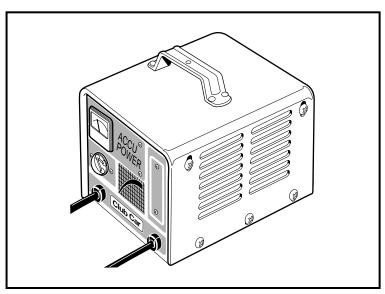


Figure 14-1 Accu-Power Battery Charger

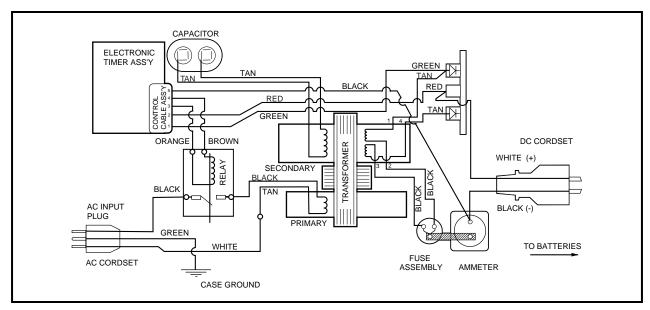


Figure 14-2 Charger Wiring Diagram

THE CHARGE CIRCUIT

The charge circuit consists of the charger receptacle, receptacle fuse link, and the batteries. The negative terminal of the receptacle is connected to the No. 6 battery by a 10 gauge white wire, and the positive terminal of the receptacle is connected to the fuse link. A 10 gauge red wire from the receptacle fuse link connects to the positive post of battery No. 1. If the charger operates properly with one vehicle, but will not operate properly with another, check this path to be sure the receptacle fuse link has not failed and all connections, including battery connections, are clean and tight (Figure 14-4, Page 14-3).

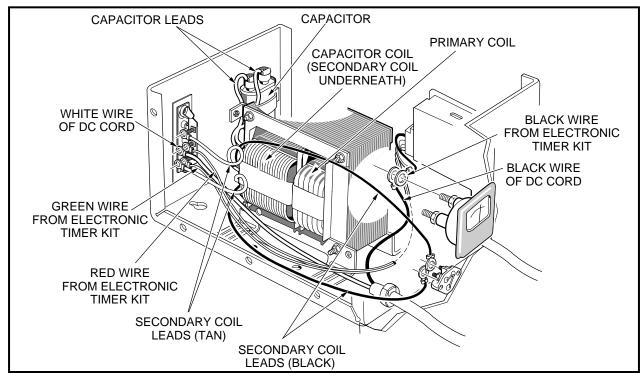


Figure 14-3 Charger Wiring

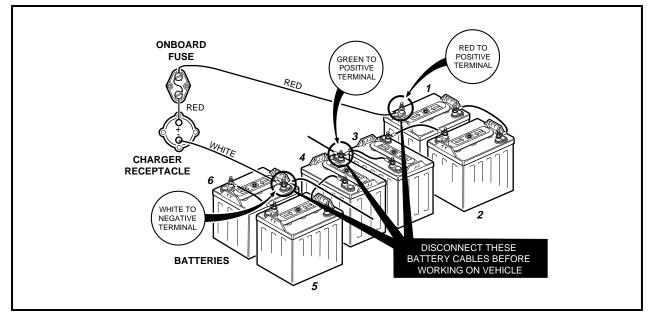


Figure 14-4 Charge Circuit

CHARGER INSTALLATION AND USE

Read DANGER and WARNING on page 14-1.

The AC line to which the charger is to be connected must be capable of supplying at least 15 amperes to each charger.

To reduce the risk of electric shock, the battery charger must be grounded. The charger is equipped with an AC electric cord with an equipment-grounding conductor and a grounding type plug. It is for use on a nominal 120 volt, 60 hertz, single-phase circuit. The AC plug must be connected to an appropriate receptacle that is properly installed and grounded in accordance with the National Electric Code and all local codes and ordinances.

The use of an extension cord with the charger is not recommended. If an extension cord must be used, use a three conductor No. 12 AWG cord with ground, properly wired and in good electrical condition. Keep it as short as possible (no more than twelve feet). Place all cords so they will not be stepped on, tripped over, or otherwise subject to damage or stress. **See following WARNING**.

WARNING

- EACH CHARGER SHOULD HAVE ITS OWN 15 OR 20 AMPERE BRANCH CIRCUIT PROTECTION (CIRCUIT BREAKER OR FUSE), IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE ANSI/NFPA 70, AND LOCAL CODES AND ORDINANCES. IMPROPER AC SUPPLY CIRCUIT PROTECTION MAY RESULT IN A FIRE.
- DO NOT USE AN ADAPTER TO PLUG A CHARGER WITH A THREE-PRONG PLUG INTO A TWO-PRONG OUTLET. IMPROPER CONNECTION OF THE EQUIPMENT-GROUNDING CONDUCTOR CAN RESULT IN A FIRE OR AN ELECTRICAL SHOCK.
- AN EXTENSION CORD OR ELECTRICAL OUTLET MUST ACCEPT A THREE-PRONG PLUG. THE USE OF AN IMPROPER EXTENSION CORD COULD RESULT IN FIRE OR AN ELECTRICAL SHOCK.
- DO NOT OPERATE THE CHARGER IF IT HAS RECEIVED A SHARP BLOW, WAS DROPPED, OR OTHERWISE DAMAGED IN ANY WAY. CHECK IT TO BE SURE IT IS OPERATING PROPERLY BEFORE PUTTING IT BACK IN USE.

Provide adequate ventilation for the charger. Keep all charger ventilation openings at least two inches away from walls and other objects.

NORMAL CHARGER OPERATION

A WARNING

- DO NOT USE THIS CHARGER IF:
 - THE PLUG IS TOO LOOSE OR DOES NOT MAKE A GOOD CONNECTION.
 - THE PLUG AND/OR RECEPTACLE BECOME HOTTER THAN NORMAL DURING CHARGE.
 - THE PLUG BLADES OR RECEPTACLE CONTACTS ARE BENT OR CORRODED.
 - THE PLUG, RECEPTACLE, OR CORDS ARE CUT, WORN, HAVE EXPOSED WIRES, OR ARE DAMAGED IN ANY WAY.
- USING THE CHARGER WITH ANY OF THE ABOVE CONDITIONS COULD RESULT IN A FIRE, PROPERTY DAMAGE, PERSONAL INJURY, OR DEATH. REPAIR OR REPLACE WORN OR DAMAGED PARTS BEFORE USING THE CHARGER.
- DO NOT ROCK OR BEND THE PLUG. TO CONNECT THE CHARGER PLUG TO THE VEHICLE RECEPTACLE, GRASP THE PLUG (NOT THE CORD) AND PUSH IT STRAIGHT INTO THE RECEPTACLE.

WARNING CONTINUED ON NEXT PAGE...

A WARNING

- TO DISCONNECT THE CHARGER PLUG FROM THE VEHICLE, GRASP THE PLUG (NOT THE CORD) AND PULL IT STRAIGHT OUT OF THE RECEPTACLE. DO NOT PULL ON THE CORD. DO NOT TWIST, ROCK, OR BEND THE PLUG SIDEWAYS.
- 1. With the charger DC output cord disconnected from the batteries, connect the power supply cord to a 120 volt, 60 hertz outlet.
- 2. Connect the charger DC plug to the charger receptacle located on the seat support panel (Figure 14-5, Page 14-5). The charger will turn ON automatically within 2 to 5 seconds after the DC plug is connected.

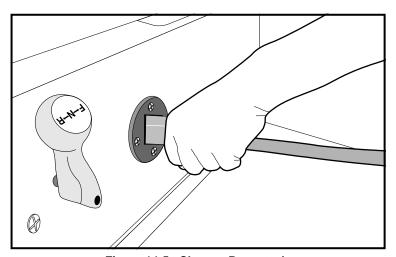


Figure 14-5 Charger Receptacle

3. Monitor the ammeter for the correct charge rate. The initial charge rate will vary from 16 to 25 amps, depending upon the condition and depth of discharge of the batteries. Slight variations in the initial charge rate may also result from AC line input voltages which are higher or lower than 120 volts. Higher line voltages increase the initial charge rate and lower line voltages reduce the initial charge rate.

NOTE

• WHEN AIR TEMPERATURES FALL BELOW 65°F (18.3°C), BATTERIES CHARGED IN UNHEATED AREAS SHOULD BE PLACED ON CHARGE AS SOON AS POSSIBLE AFTER USE. BATTERIES ARE WARMEST IMMEDIATELY AFTER USE, AND COLD BATTERIES REQUIRE MORE TIME TO FULLY CHARGE.

TROUBLESHOOTING

Read DANGER and WARNING on page 14-1.

A DANGER

 HIGH VOLTAGE! THE VOLTAGE OF THE CAPACITOR INSIDE THE CHARGER IS APPROXI-MATELY 650 VOLTS. USE EXTREME CAUTION WHEN WORKING NEAR CAPACITOR TERMI-NALS.

ACCU-POWER BATTERY CHARGER TROUBLESHOOTING GUIDE				
	SYMPTOM		POSSIBLE CAUSES	REFER TO
1.	Relay does not close, no transformer hum and ammeter does not move.	1)	Batteries disconnected.	Figure 14-4, Page 14-3.
		2)	Battery voltage is too low.	Test Procedure 1, Page 14-7
		3)	Poor connection between plug and receptacle.	Test Procedure 1,Page 14-7
		4)	DC plug and cord.	Test Procedures 1 and 9, Pages 14-7 & 14-13
		5)	Electronic Timer Kit malfunction.	Test Procedure 2, Page 14-8
		6)	Onboard receptacle fuse link is blown.	Page 14-16
2.	Relay closes with an audible click but no transformer hum and ammeter does not move.	1)	Improper AC outlet voltage.	Test Procedure 3, Page 14-9
		2)	Failed AC plug and cord.	Test Procedure 3, Page 14-9
		3)	Improper wiring of Electronic Timer Kit.	Figure 14-2, Page 14-2
		4)	Transformer primary coil.	Test Procedure 7, Page 14-12
		5)	Relay.	Test Procedure 9, Page 14-13
3.	Relay closes and transformer hums but ammeter does not move.	1)	Blown charger fuse.	Test Procedure 4-B, Page 14-10
		2)	Both diodes failed.	Test Procedure 4-B, Page 14-10
		3)	Failed capacitor.	Test Procedure 6, Page 14-11
		4)	Failed transformer.	Test Procedure 7, Page 14-12
		5)	Failed charger relay.	Test Procedure 9, Page 14-13
		6)	Failed ammeter.	Test Procedure 9, Page 14-13
4.	Single charger fuse link blows.	1)	Diode failed.	Test Procedure 4-A, Page 14-9
		2)	Loose internal fuse connection.	Test Procedure 4-A, Page 14-9
5.	Both charger fuse links blow or receptacle fuse link blows.	1)	Battery is wired in reverse polarity.	Test Procedure 4-B, Page 14-10
		2)	DC cord is wired in reverse polarity.	Test Procedure 4-B, Page 14-10
		3)	Both diodes failed.	Test Procedure 4-B, Page 14-10
6.	Charger output is low.	1)	One diode failed.	Test Procedure 4-A, Page 14-9
		2)	Transformer coil short-circuit failure.	Test Procedure 7, Page 14-12
7.	Charger turns OFF too soon.	1)	AC power supply was turned off.	Test Procedure 3, Page 14-9
		2)	Batteries may be fully charged.	Test Procedure 8, Page 14-13
8.	Charger does not turn OFF.	1)	Electronic Timer Kit has failed.	Test Procedure 2, Page 14-8
		2)	Electronic Timer Kit is improperly wired.	Test Procedure 2, Page 14-8
		3)	Bad battery.	Section 13–Batteries
9.	AC line fuse or circuit breaker blows.	1)	Electronic Timer relay.	Test Procedure 2 or 9, Pages 14-8 & 14-13
		2)	AC plug or cord is shorted.	Test Procedure 9, Page 14-13
		3)	Failed transformer.	Test Procedure 7, Page 14-12

TEST PROCEDURES

Read DANGER and WARNING on page 14-1.

The charger uses DC battery voltage to close an internal relay which in turn closes the AC circuit. When the charger is operating properly, there is a 2 to 5 second delay after the DC cord is plugged into the vehicle before the relay closes. This delay allows time for the DC plug to make a secure connection with the receptacle before the AC circuit is activated and AC power is supplied to the primary coil of the transformer. When the relay closes an audible "click" can be heard, and then as power is supplied, the transformer should hum and the ammeter should indicate the charge rate.

INDEX OF TEST PROCEDURES

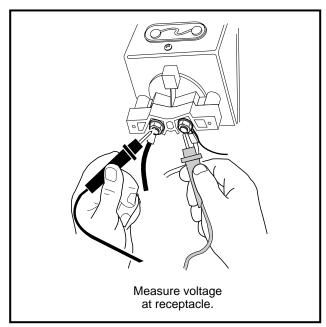
- 1. Battery Voltage is Too Low or Faulty Connection Between Plug and Receptacle
- 2. Electronic Timer Kit
- 3. AC Power and Continuity Check of AC Circuit
- 4. Diodes
- 5. Continuity Test of Charger DC Circuit
- 6. Capacitor
- 7. Transformer
- 8. Battery State of Charge Test
- 9. Continuity

Test Procedure 1– Battery Voltage is Too Low or Faulty Connection Between Plug and Receptacle

- 1. Check the DC plug and the receptacle for damage, dirt, corrosion, etc., that might prevent a sound electrical connection.
- 2. Measure the voltage at the receptacle using a multimeter set to 200 volts DC (Figure 14-6, Page 14-8).
- Measure battery terminal voltage between the positive post on battery No. 1 and the negative post on battery No. 6 (Figure 14-7, Page 14-8). The voltage reading should be the same as at the receptacle.

NOTE

- TO CLOSE THE CHARGER RELAY, BATTERY VOLTAGE MUST BE BETWEEN 27 AND 50 VOLTS.
- 4. If the voltage readings obtained at the receptacle and at the batteries are not the same, check the wire connections at the receptacle and at the batteries. If the DC voltages are the same and within limits, remove the charger cover and verify that the charger is properly wired. With the AC cord disconnected, insert the DC plug into the charger receptacle. With a multimeter set to 200 volts DC, measure battery voltage at the white and black wires from the DC cord inside the charger (Figures 14-2 and 14-3, Pages 14-2 and 14-3). The voltage reading should be the same as at the receptacle. If battery pack voltage is too low to start the charger, see Charging a Battery Pack that has Low Voltage, Page 14-22. See also Test Procedure 9. See DANGER and WARNING on page 14-5.



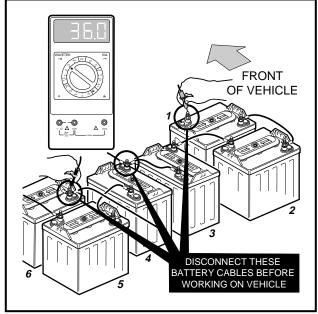


Figure 14-6 Voltage at Receptacle

Figure 14-7 Battery Terminal Voltage

Test Procedure 2- Electronic Timer Kit

- Connect the charger AC plug to an outlet, then connect the DC plug to the vehicle. After a 2 to 5 second delay, the charger should start. If the charger starts immediately (without a 2 to 5 second delay), the electronic timer relay has failed.
- 2. If the charger does not turn off automatically when batteries are fully charged, check the connections of the green wire on the heatsink and check the relay (see Test Procedure 9). If the wire connections are secure and the relay has not failed, the electronic timer kit must be replaced. To verify the timer is malfunctioning:
 - 2.1. Unplug AC and DC cords and remove the cover from the charger. See DANGER on page 14-5.
 - 2.2. Locate and carefully remove the two black wires connected to the contact terminals of the relay.
 - 2.3. Place a relay bypass wire (14 AWG minimum) between the two black wires (Figure 14-13, Page 14-12).
 - 2.4. The power supply cord is now connected directly to the primary transformer coil and the transformer should hum when the AC cord is plugged into a live outlet.
 - 2.5. Disconnect the AC cord.
 - 2.6. Charger operation may now be checked by connecting the DC plug into the receptacle, and then connecting the AC cord into an outlet. If normal charging current is indicated on the ammeter, the electronic timer and/or the relay has failed and must be replaced. See Test Procedure 9 for relay testing. See following CAUTION.

A CAUTION

- **DO NOT** CHARGE BATTERIES WITH THE ELECTRONIC TIMER KIT BYPASSED. IF THE TIMER KIT IS BYPASSED, THE CHARGER WILL REMAIN OPERATING AS LONG AS THE AC CORD IS PLUGGED INTO AN OUTLET. SEVERE OVERCHARGING AND EVENTUAL DAMAGE TO THE BATTERIES WILL RESULT.
 - 2.7. If the transformer does not hum and the ammeter still does not register with the relay bypassed, it will be necessary to check the continuity of the charger AC circuit. **See Test Procedure 3**.

Test Procedure 3- AC Power and Continuity Check of AC Circuit

- 1. Unplug AC and DC cords.
- 2. Check the AC line fuse or circuit breaker in the storage facility.
- 3. Insert the probes of a multimeter, set to 500 volts AC, into the AC outlet to check incoming AC voltage. A reading of 105 to 128 volts should be obtained.
- 4. If AC power is not present, have a licensed electrical contractor check the building wiring and service panel.
- 5. Check continuity of the AC circuit: See DANGER on page 14-5.
 - 5.1. Carefully disconnect the two black wires attached to the contact terminals of the relay.
 - 5.2. Connect a jumper wire between the two black wires.
 - 5.3. With relay bypassed, check the circuit across the AC cord plug blades (Figure 14-8, Page 14-9).
 - 5.4. If the reading is no continuity, check the wiring of the AC cord, the transformer primary coil leads, and the jumper wire. If the charger is wired correctly, check, individually, the continuity of the AC cord, the transformer primary coil, and the jumper wire.

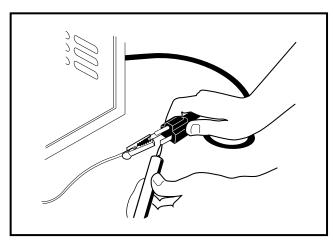


Figure 14-8 Test AC Plug Blades

Test Procedure 4– Diodes

Use Test Procedure 4A for single diode failures and diode testing. If both diodes have failed, use Test Procedure 4B.

Test Procedure 4A – Single Diode Failure

A single diode failure is indicated by the failure of one fuse link (short circuited diode) or by low charger output (open circuit diode). If a diode has failed, the entire heatsink assembly must be replaced. To check the diodes:

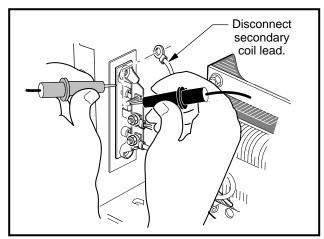
- 1. Unplug the AC cord from its outlet and unplug the DC cord from the vehicle receptacle.
- 2. Disconnect one transformer secondary coil lead from the diode terminal (Figure 14-2, Page 14-2).
- Using a low voltage continuity tester or multimeter set to diode, place one tester probe on the diode mounting plate and the other probe on a diode terminal and note the reading (Figure 14-9, Page 14-10).
- 4. Reverse the tester probes and check each diode again (Figure 14-10, Page 14-10). A diode is designed to conduct current in only one direction. If a diode shows continuity in both directions, the entire heatsink assembly with diodes must be replaced. If a diode shows no continuity in either direction, the entire heatsink assembly must be replaced.

Test Procedure 4A, Continued:

- 5. Check all three fuse connections inside the charger to be sure they are clean and tight. It is possible that a loose internal fuse connection could create enough heat to cause a single fuse link to melt. The proper torque on all fuse link connections is 20 in-lb (2.3 N-m).
- 6. Be sure the charger is wired properly and all connections are clean and tight.

A CAUTION

• IF CONNECTIONS ARE NOT CLEAN AND TIGHT, EXCESSIVE HEAT WILL BE CREATED AND THE CHARGER MAY BE DAMAGED.





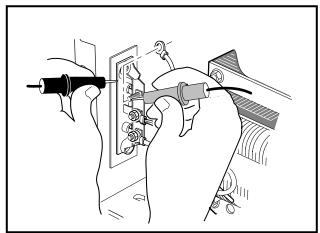


Figure 14-10 Reverse Tester Leads

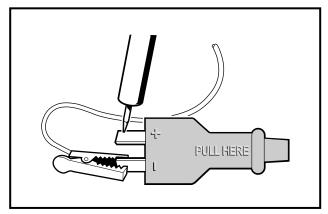
Test Procedure 4B- Both Diodes Failed

Use Test Procedure 4A to test diodes. If both diodes have failed closed (shorted), both charger fuse links will be blown. If both diodes have failed open, the relay will close and the transformer will hum, but the ammeter will indicate *no* output. If both diodes have failed open or have shorted, the entire heatsink assembly must be replaced. To determine why both diodes failed:

- Check the batteries and the receptacle to be sure they are wired in the correct polarity. Use a multimeter to check the voltage and polarity at the receptacle.
- 2. Make sure the charger DC plug is wired correctly. The white wire should be connected to the center terminal of the heatsink assembly and the black wire should be connected to the left side of the ammeter when viewed from inside the charger. Whether or not the AC cord is plugged into an outlet, both fuse links will blow if a reversed polarity connection is made between the charger and the batteries.
- 3. Although it is a rare occurrence, both diodes may fail due to a lightning strike at the charging location.
- 4. Excessive heat due to a loose connection could also cause both fuse links to melt. Be sure fuse connections are tightened to 20 in-lb (2.3 N-m).
- 5. Make sure the charger is wired properly and all connections are clean and tight.

Test Procedure 5– Continuity Test of Charger DC Circuit

- 1. Connect the probes of a continuity tester (Club Car Part No. 1011273) to the blades of the charger DC plug and note the reading (Figure 14-11, Page 14-11).
- 2. Reverse the probes (Figure 14-12, Page 14-11) and note the reading.



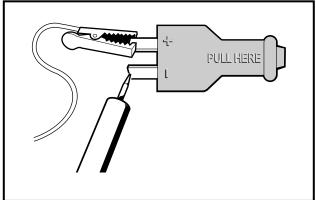


Figure 14-11 Charger DC Plug

Figure 14-12 Charger DC Plug, Reverse Probes

- 3. Continuity should be observed in only one direction. If the circuit shows no continuity in either direction and the fuse is functional, check the continuity of the DC plug and cord (**Test Procedure 9**), the ammeter (**Test Procedure 9**), the diodes (**Test Procedure 4A**), and all connections.
- 4. If the circuit indicates continuity in both directions, a short circuit exists in the charger DC circuit, probably caused by failed diodes (see Test Procedure 4). If the diodes have not failed, check the DC output cord for a short circuit between the two wires (Test Procedure 9).
- If the test shows the charger DC circuit is functional, check the capacitor (Test Procedure 6).

Test Procedure 6– Capacitor

A DANGER

 HIGH VOLTAGE! WITH THE CHARGER ON, THE VOLTAGE OF THE CAPACITOR INSIDE THE CHARGER IS APPROXIMATELY 650 VOLTS. USE EXTREME CAUTION WHEN WORKING NEAR CAPACITOR TERMINALS.

A CAUTION

- TO AVOID BREAKING WIRES, DISCONNECT CAPACITOR LEADS CAREFULLY.
- 1. Disconnect both transformer coil leads from the capacitor terminals.
- 2. Using insulated pliers, place uninsulated tips onto capacitor terminal ends to discharge capacitor.
- 3. Place probes of a multimeter, set to 2000k Ω (ohms), on the capacitor terminals and note the reading.
- 4. Reverse the probes and note the reading.
- 5. Interpret the readings as follows:
- Functional Capacitor When the multimeter probes are connected to the capacitor terminals, initially meter indicates low resistance then rapidly moves to high resistance and eventually to open circuit.
- Open Capacitor When the multimeter leads are connected to the capacitor terminals, and the meter does not indicate any initial resistance and only open circuit, the capacitor has failed open. A bulge in the top of the capacitor may be visible if the capacitor has failed open.
- **Shorted Capacitor** When the multimeter probes are connected to the capacitor terminals, and the meter indicates a closed circuit and does not change, the capacitor has failed closed.
- 6. If the capacitor is open or shorted, it must be replaced.

WARNING

 USE A CLUB CAR CAPACITOR (PART NO. 1015910) ONLY. THE USE OF A DIFFERENT VALUE CAPACITOR MAY RESULT IN IMPROPER CHARGING, CAPACITOR FAILURE, TRANSFORMER BURNOUT, AND/OR BATTERY DAMAGE.

Test Procedure 7- Transformer

Failure of the transformer could be caused by natural aging or premature shorting of adjacent coil turns. If the transformer has failed, ammeter would indicate no output or low output even though the transformer might hum. A failed transformer could cause an AC line fuse to blow or a circuit breaker to trip in the storage facility. To check the transformer:

- Disconnect the transformer secondary coil leads (1) and (4) from the diode terminals (Figure 14-13, Page 14-12). Remount nuts on diode assembly. See following DANGER.
- 2. Disconnect the transformer capacitor coil leads (5) and (6) from the capacitor terminals (Figure 14-13, Page 14-12). See following DANGER.

DANGER

- DO NOT ALLOW THE SECONDARY COIL LEADS TO TOUCH EACH OTHER. THERE ARE APPROXIMATELY 61 VOLTS AC PRESENT.
- DO NOT ALLOW THE CAPACITOR COIL LEADS TO TOUCH EACH OTHER. THERE ARE APPROXIMATELY 650 VOLTS AC PRESENT.
- HIGH VOLTAGE! WITH THE CHARGER ON, THE VOLTAGE OF THE CAPACITOR INSIDE THE CHARGER IS APPROXIMATELY 650 VOLTS. USE EXTREME CAUTION WHEN WORKING NEAR CAPACITOR TERMINALS.
- 3. In order to supply AC power directly to transformer coil, relay must be bypassed. Refer to Test Procedure 2.
- 4. Make sure the capacitor coil leads and the secondary coil leads are not touching one another. Then, with the relay by-passed, plug the AC cord into an outlet. If the AC line fuse blows or the circuit breaker trips, the transformer has failed internally and must be replaced.

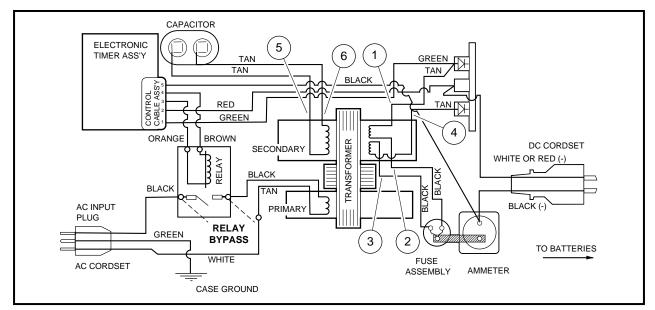


Figure 14-13 Relay Bypass Wire Placement

- 5. If this does not occur, use a multimeter, set to 500 volts AC, to check transformer secondary voltage across lead Nos. 1 and 4, and capacitor coil voltage across lead Nos. 5 and 6 (Figure 14-13, Page 14-12). If measured voltages are approximately 48 volts or lower for secondary coil, or less than approximately 385 volts for capacitor, the transformer is shorted internally and must be replaced. See previous DANGER.
- 6. If the transformer output voltages are correct, disconnect the AC cord from the outlet and proceed as follows:
 - 6.1. Check the capacitor to be sure its rating is 3 microfarads (capacitor should be marked), 660 volts AC, and then carefully reconnect the capacitor coil lead Nos. 5 and 6 to the capacitor terminals.
 - 6.2. After making sure the secondary coil leads are not touching one another, connect the AC cord to an outlet and measure the transformer secondary voltage across lead Nos. 1 and 4.
 - 6.3. If the voltage reading is the same as the voltage reading in step 5 (which eliminates the capacitor from the circuit), the capacitor may have failed or the coil leads may not be making proper electrical contact (see Test Procedure 6). If the voltage readings are correct, both the transformer and the capacitor are functional; refer to Test Procedure 5 for further tests of the DC circuit.

Test Procedure 8– Battery State of Charge Test

- When the charger has turned off after a charge cycle, disconnect and then reconnect the charger AC plug. The ammeter should jump to 18-22 amps and taper to below 12 amps within 15 minutes. If it tapers to below 12 amps within 15 minutes, the batteries are fully charged and the charger is functioning properly.
- 2. If the charger does not taper to below 12 amps within 15 minutes, the batteries may not be receiving a full charge and the Electronic Timer Kit should be checked. **See Test Procedure 2**.

NOTE

• OLD BATTERIES NEAR THE END OF THEIR USEFUL LIVES MAY NOT TAPER TO BELOW 12 AMPS. SEE SECTION 13-BATTERIES.

Test Procedure 9– Continuity

AC Cord and Plug

- Disconnect black wire (1) of AC cord from the contact terminal of the relay (Figure 14-14, Page 14-14).
- 2. Disconnect the green wire (2) from the charger case (Figure 14-14, Page 14-14).
- 3. With a multimeter set at 200 Ω (ohms), connect the positive (+) probe to the end of the black wire (1) and check for continuity on both flat blades and on the ground blade of the AC plug (Figure 14-14, Page 14-14). Continuity should be shown on only one flat blade. If any other reading is obtained, the AC cord and plug must be replaced.
- 4. Carefully cut the heat shrink (4) that insulates the AC cord white wire where it connects to the tan primary coil wire.
- 5. Disconnect white wire terminal connector (4) at the tan primary coil wire. Insert red probe into the white wire terminal end (4). Place black probe on each flat blade and then on the ground pin and check for continuity. Continuity should be shown on only one flat blade. If any other reading is obtained, the AC cord and plug must be replaced (Figure 14-14, Page 14-14).
- 6. Attach alligator clip to end of green wire (2) and check for continuity on both flat blades and ground pin of AC plug (Figure 14-14, Page 14-14). Continuity should be shown on only ground pin. If any other reading is obtained, AC cord and plug must be replaced.
- 7. If the measurements taken in the above steps indicate that the AC cord is not functioning correctly, the cord must be replaced before the charger is placed back into service. **See Charger AC Cord on page 14-20.**
- 8. If the AC cord is functioning properly, reinstall the cord.
 - 8.1. Connect the black wire to the charger relay, and the green wire to the charger base. Tighten the screw on the green (ground) wire terminal to 18 in-lb (2 N-m) (Figure 14-18, Page 14-21).

Test Procedure 9, Continued:

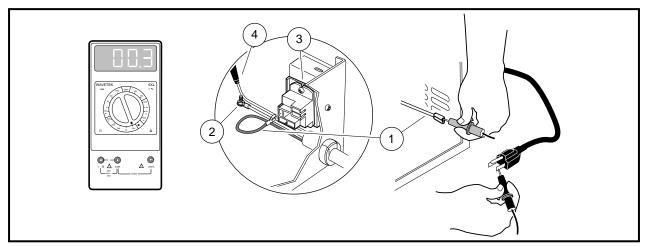


Figure 14-14 AC Plug

- 8.2. Place a piece of heat shrink tubing over the AC cord white wire.
- 8.3. Connect the white wire to the tan primary coil wire (Figure 14-18, Page 14-21).
- 8.4. Slide the heat shrink tubing over the connection and apply heat to the heat shrink to insulate the connection between the AC cord white wire and the tan primary coil wire. See following WARN-ING.

A WARNING

 MAKE SURE THE ELECTRICAL CONNECTIONS ARE PROPERLY INSULATED. FAILURE TO PROPERLY INSULATE ELECTRICAL CONNECTIONS IN THE CHARGER COULD RESULT IN A SHORT CIRCUIT.

DC Cord and Plug

- 1. Disconnect the black wire (5) of the DC cord from the ammeter, and disconnect the white wire of the DC cord from the heatsink assembly (Figure 14-15, Page 14-16).
- 2. Attach alligator clip of continuity tester to the white wire (6) of the DC cord (Figure 14-15, Page 14-16).
- 3. Place the probe of the continuity tester on the positive (+) blade of the DC plug (the positive and negative blades are identified on the plug). The tester should indicate continuity. If the tester does not indicate continuity, the DC cord and plug must be replaced.
- 4. Place the probe of the tester on the negative (–) blade of the DC plug. The tester should indicate no continuity. If the tester indicates continuity, the cord and plug must be replaced.
- 5. Attach alligator clip to the black wire (5) of the DC cord and then place the probe on the negative (–) blade of the DC plug (Figure 14-15, Page 14-16). The tester should indicate continuity. Place the probe on the positive (+) side. The reading should be no continuity. If the readings are not correct, the cord and plug must be replaced.

Transformer

The transformer has three coils that must be tested (Figure 14-3, Page 14-3).

- 1. Test the Primary Coil:
 - 1.1. Disconnect the transformer primary coil leads from the terminals.
 - 1.2. Place the continuity tester probes on the primary coil leads. The tester should indicate continuity. If the tester indicates no continuity, replace the transformer.
- 2. Test the Secondary Coil:

- 2.1. Disconnect the transformer secondary coil lead from the upper terminal of the heatsink assembly.
- 2.2. Disconnect the other transformer secondary coil lead from the upper terminal of the heatsink assembly, then place the tester probes on the secondary coil leads (tan wires). The reading should be continuity. If the reading is no continuity, replace the transformer. Be sure the fuse is intact and has not failed. See DANGER on page 14-11.
- 3. Test the Capacitor Coil:
 - 3.1. Disconnect the transformer capacitor coil leads from the capacitor terminals.
 - 3.2. Place the tester probes on the capacitor coil leads. The reading should be continuity. If the reading is no continuity, replace the transformer.

Relay

A WARNING

- BEFORE PERFORMING THIS TEST, MAKE SURE THE AC PLUG IS NOT PLUGGED IN.
- 1. Disconnect the two black wires from the contact terminals of the relay.
- 2. Place the continuity tester probes on the contact terminals of the relay. The reading should be **no** continuity. If the tester shows continuity, the relay contacts are welded shut and the relay must be replaced.
- Plug the DC cord into a vehicle receptacle (make sure the vehicle batteries are connected), then place the tester probes on the contact terminals of the relay. The reading should be continuity; if the tester shows *no* continuity, the relay must be replaced.

Ammeter

- 1. Disconnect both black wires from the left (when viewed from inside the charger) ammeter post.
- 2. Attach the alligator clip of the tester to one of the ammeter posts.
- 3. Place the tester probe on the other ammeter post. The reading should be continuity. If the tester indicates *no* continuity, the ammeter must be replaced.

PLUG AND CORD REPLACEMENT

Read DANGER and WARNING on page 14-1.

The charger DC cord and plug, and the charger receptacle on the vehicle are wear items that should be inspected daily. They *must* be replaced when worn or damaged. If the charger plug and receptacle show signs of corrosion or are becoming difficult to insert and remove, the receptacle contacts and plug blades can be cleaned with a good electrical contact cleaner or lightly sprayed with WD-40® brand spray lubricant. See Testing the Charger Receptacle, in Section 12 on page12-15. See also Charger Receptacle Inspection, in Section 12 on page12-15.

CHARGER DC CORD REPLACEMENT

DC Cord Removal

- 1. Unplug the AC and DC cords and remove the charger cover. See DANGER and WARNING on page 14-5.
- 2. Disconnect the black lead of the DC cord from the ammeter by loosening the nut (1). Support the terminal as the nut is loosened to prevent rotation of the connection. Leave the black wire from the electronic timer (4) on the terminal post (Figure 14-15, Page 14-16).
- 3. Remove the nut that retains the white lead of the DC cord on the heatsink assembly. Leave the red wire from the electronic timer on the screw at the heatsink assembly.
- 4. Using pliers, squeeze the strain relief bushing and remove the cord set.

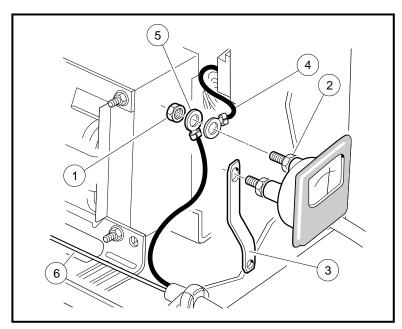


Figure 14-15 DC Cord

DC Cord Installation

- 1. Insert the leads of the new cord through the hole in the charger base.
- 2. Make sure the red wire of the electronic timer is on the middle terminal of the heatsink assembly, then place the white lead of the new cord on the terminal and tighten the nut to 14 in-lb (1.5 N-m).
- 3. Make sure the black wire (4) of the electronic timer is on the ammeter post. Attach the black lead (5) of the new cord and tighten nut (1) on the post until finger tight (Figure 14-15, Page 14-16). See following CAUTION.

CAUTION

- DO NOT ALLOW AMMETER POST TO ROTATE AS NUT IS TIGHTENED. IF IT ROTATES, THE AMMETER COULD BE DAMAGED.
- 4. While holding the outside of the nut (1), turn the inside nut (2) counterclockwise 1/4 turn (Figure 14-15, Page 14-16). See previous CAUTION and following NOTE.

NOTE

- CHECK THE POSITIONS OF THE TERMINALS TO MAKE SURE THEY ARE NOT TOUCHING THE AMMETER BUS BAR (3) OR THE AMMETER POST (FIGURE 14-15, PAGE 14-16).
- 5. Place the strain relief bushing on the cord and use pliers to insert bushing into the charger base.
- 6. Place the charger cover in position and install the mounting screws, starting with the bottom holes. Tighten the screws to 11 in-lb (1.2 N-m).

CHARGER REPAIRS

ELECTRONIC TIMER KIT

Read DANGER and WARNING on page 14-1.

Electronic Timer Kit Removal

- 1. Disconnect the AC and DC cords and remove the charger cover.
- 2. Remove the two screws attaching the electronic timer assembly to the face of the charger.
- 3. Slide the electronic timer assembly from the charger and carefully remove the control cable connector from the timer.

Electronic Timer Kit Installation

- 1. Carefully connect the control cable connector to the new timer and slide the timer assembly into the charger.
- 2. Install the two timer assembly retaining screws in the face of the charger.

Electronic Timer Relay Wiring

If the wires from the relay were disconnected, connect them to the numbered relay terminals as follows:

- 1. Attach the orange wire to terminal No. 6.
- 2. Attach the brown wire to terminal No. 1.
- 3. Attach the black wire from the AC cord to terminal No. 3.
- 4. Attach the black extension wire from the transformer primary coil to terminal No. 5.

A WARNING

• MAKE SURE ALL CONNECTIONS ARE CLEAN AND TIGHT. MAKE SURE ALL WIRES AND TERMINALS ARE POSITIONED SO THEY DO NOT SHORT TOGETHER OR TO CHARGER BASE.

Checking Proper Operation of Electronic Timer Kit

- 1. With the DC plug disconnected from the receptacle, plug the AC cord into an outlet. The relay on the electronic timer kit should not close. A multimeter set to 200 volts DC and connected across the DC plug should indicate zero volts. The transformer should not hum.
- 2. Unplug the AC cord from its outlet and connect the DC plug to the receptacle. The relay, located next to the electronic timer kit, should close with an audible "click" after a two to five second delay.
- 3. If the electronic timer kit does not operate as in step one or two above, refer to the wiring diagram (Figure 14-2, Page 14-2) and make sure the charger is wired correctly. If the electronic timer kit operates properly, the charger is ready for use. Always monitor the first charge cycle to verify the charger is turning OFF properly.

CAPACITOR

Read DANGER and WARNING on page 14-1.

Capacitor Removal

- 1. Disconnect the AC and DC cords and remove the charger cover. See DANGER on page 14-5.
- 2. Loosen the mounting band screw (Figure 14-16, Page 14-18). See CAUTION on page 14-10.
- 3. Remove the connectors from the capacitor terminals.
- 4. Pull the capacitor out of the band.

Capacitor Installation

- 1. Route the capacitor wires through the band and then slide the capacitor into the band.
- 2. Tighten the mounting band screw.
- 3. Connect the terminal connectors to the capacitor terminals.
- 4. Install the charger cover and check the charger for proper operation.

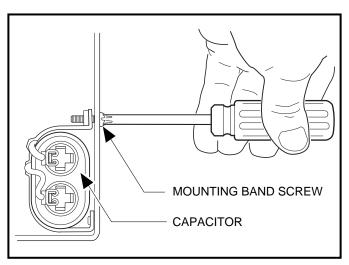


Figure 14-16 Capacitor

HEATSINK ASSEMBLY

Read DANGER and WARNING on page 14-1.

Heatsink Assembly Removal

- 1. Disconnect the AC and DC cords and remove the charger cover. See DANGER on page 14-5.
- 2. Disconnect both secondary transformer leads (tan) from the heatsink assembly.
- 3. Disconnect the red, green, and white wires from the heatsink assembly.
- 4. Remove the nuts and bolts which secure the heatsink assembly to the case.

Heatsink Assembly Installation

- Mount the heatsink assembly to the charger case. Make sure the clear plastic strip, which is coated with a white di-electric grease, is against the charger case and install the nuts and bolts that secure the assembly to the charger case. Tighten the bolts to 13 in-lb (1.4 N-m).
- 2. Connect the white wire from the DC cord and the red wire of the control cable to the center connector of the heatsink assembly. Tighten the nut to 18 in-lb (2 N-m).
- 3. Connect the green wire of the control cable and one of the secondary transformer leads (tan) to the bottom connector of the heatsink assembly. Tighten the nut to 18 in-lb (2 N-m).
- 4. Connect the other secondary transformer lead (tan) to the top connector of the heatsink assembly.
- 5. Install the charger cover and check the charger for proper operation.

TRANSFORMER

Read DANGER and WARNING on page 14-1.

Transformer Removal

- Disconnect the AC and DC cords and remove the charger cover (Figure 14-3, Page 14-3). See DAN-GER on page 14-5.
- 2. Disconnect the black extension wire and the transformer primary coil lead, then disconnect the white wire in the AC cord and the transformer coil lead.
- 3. Disconnect the secondary transformer leads from the heatsink assembly.
- 4. Disconnect the secondary transformer leads from the fuse assembly.
- 5. Disconnect the capacitor coil leads from the capacitor. See DANGER on page 14-11.

- 6. Remove the plastic wire tie holding the red and green wires of the control cable and one secondary transformer lead (from the heatsink assembly) together.
- 7. Remove the four bolts and nuts from the transformer and remove the transformer.

Transformer Installation

- 1. Position the transformer in the charger, oriented with the secondary coil lead to the rear. Install the four mounting bolts and nuts and tighten them to 28 in-lb (3.0 N-m).
- 2. Connect one secondary transformer lead (tan) to the top of the heatsink assembly. Tighten the nut to 13 in-lb (1.4 N-m).
- 3. Connect the green wire of the control cable and the other secondary transformer lead (tan) to the bottom terminal of the heatsink assembly. Tighten the nut to 23 in-lb (2.5 N-m).
- 4. Connect one secondary transformer lead (black) to one terminal of the fuse assembly. Tighten the nut to 23 in-lb (2.5 N-m).
- 5. Connect the other secondary transformer lead (black) to the remaining terminal of the fuse assembly. Tighten the nut to 23 in-lb (2.5 N-m).
- 6. Connect the capacitor coil leads to the capacitor.
- 7. Tie the wires together as they were before the wire tie was removed. See following WARNING.
- 8. Install the charger cover and check the charger for proper operation.

A WARNING

• MAKE SURE WIRING PROPERLY SECURED. FAILURE TO PROPERLY SECURE WIRING COULD RESULT IN CHARGER MALFUNCTION, PROPERTY DAMAGE OR SEVERE PERSONAL INJURY.

AMMETER

Read DANGER and WARNING on page 14-1.

Ammeter Removal

- 1. Disconnect the AC and DC cords and remove the charger cover.
- 2. Disconnect all wires (4 and 5) and the bus bar (3) from the ammeter posts (Figure 14-17, Page 14-19).
- 3. Remove nuts (2) attaching ammeter to charger face, and remove the ammeter (Figure 14-17, Page 14-19).

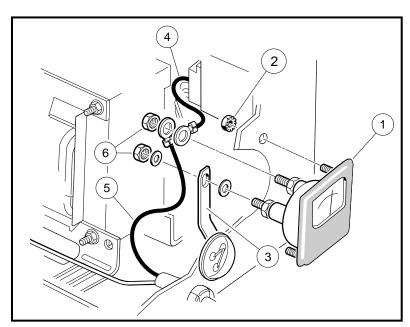


Figure 14-17 Ammeter

Ammeter Installation

- 1. Position the ammeter in the charger face and install the mounting nuts. See DANGER on page 14-5.
- 2. Install the ammeter bracket on the back of the ammeter.
- 3. Connect the black wire (4) of the electronic timer kit and the black wire (5) of the DC cord to the left post of the ammeter (when viewed from the rear of the charger) (Figure 14-17, Page 14-19).
- 4. Connect the bus bar (3) from the fuse link to the right post of the ammeter. Make sure there is a washer on each side of the bus bar.
- 5. Install the nuts on both posts of the ammeter and tighten slightly more than finger tight. Then while holding the outside nut, turn the inside nut counterclockwise 1/4 turn. **See CAUTION on page 14-15.**
- 6. Install the charger cover.
- 7. Plug the charger into a vehicle and make sure the ammeter is operating properly.

FUSE LINK

Read DANGER and WARNING on page 14-1.

Fuse Link Assembly Removal

- 1. Disconnect the AC and DC cords and remove the charger cover.
- 2. Remove both secondary transformer leads and the bus bar from the back of the fuse link assembly.
- 3. Remove the fuse link retaining screws from the face of the charger and remove the fuse link assembly.

Fuse Link Assembly Installation

- 1. Place the plastic cover over the fuse assembly and position the assembly on the charger face, then install the mounting screws from the front of the charger face.
- 2. Install the bus bar over center branch of fuse assembly and ammeter post. Tighten to 23 in-lb (2.6 N-m).
- Connect one of the secondary transformer leads (black) to one of the remaining terminals on the back of the fuse assembly. Connect the remaining secondary transformer lead (black) to the remaining terminal. Tighten to 23 in-lb (2.6 N-m).
- 4. Install the charger cover.

CHARGER RELAY

Read DANGER and WARNING on page 14-1.

Charger Relay Removal

- 1. Disconnect the AC and DC cords and remove the charger cover.
- 2. Disconnect the orange, brown and black wires from the relay (Figure 14-18, Page 14-21).
- 3. Remove two nuts and lock washers attaching relay to the L-bracket (Figure 14-18, Page 14-21).
- 4. Remove the relay.

Charger Relay Installation

 Install in reverse order of removal. Connect wires as shown (Figure 14-18, Page 14-21). Tighten the nuts connecting relay to the L-shaped relay bracket to 18 in-lb (2.0 N-m).

CHARGER AC CORD

Read DANGER and WARNING on page 14-1.

AC Cord Removal

- 1. Disconnect the AC and DC cords and remove the charger cover.
- 2. Disconnect the AC cord black wire from the charger relay (Figure 14-18, Page 14-21).

AC Cord Removal, Continued:

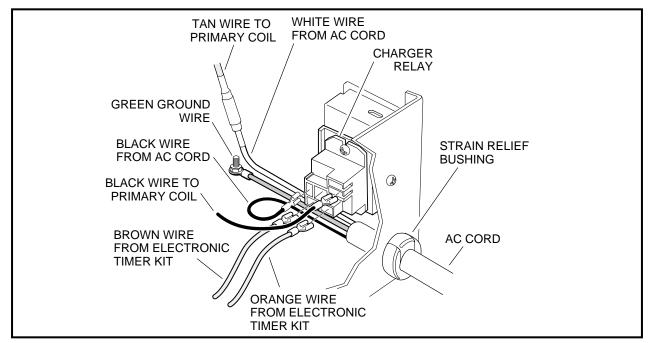


Figure 14-18 Charger Relay and AC cord

- 3. Carefully cut the heat shrink that insulates the AC cord white wire where it connects to the tan primary coil wire.
- 4. Disconnect the AC cord white wire at the primary coil tan wire (Figure 14-18, Page 14-21).
- 5. Disconnect the AC cord green wire at the charger base (Figure 14-18, Page 14-21).
- 6. Use a pair of pliers to grip the strain relief bushing and remove it and the AC cord from the charger.

AC Cord Installation

- 1. Insert the black, white, and green leads of the new AC cord into the charger through the hole in the charger face (Figure 14-18, Page 14-21).
- 2. Connect the black wire to the charger relay, and the green wire to the charger base. Tighten the screw on the green (ground) wire terminal to 18 in-lb (2 N-m) (Figure 14-18, Page 14-21).
- 3. Place a piece of heat shrink tubing over the AC cord white wire.
- 4. Connect the white wire to the tan primary coil wire (Figure 14-18, Page 14-21).
- 5. Slide the heat shrink tubing over the connection and apply heat to the heat shrink to insulate the connection between the AC cord white wire and the tan primary coil wire. **See following WARNING.**

A WARNING

- MAKE SURE THE ELECTRICAL CONNECTIONS ARE PROPERLY INSULATED. FAILURE TO PROPERLY INSULATE ELECTRICAL CONNECTIONS IN THE CHARGER COULD RESULT IN A SHORT CIRCUIT.
- 6. Position the strain relief bushing on the AC cord.
- 7. Using pliers, install the strain relief bushing and AC cord into the mounting hole in the charger face.
- 8. Install the charger cover.

CHARGING A BATTERY PACK THAT HAS LOW VOLTAGE

Read DANGER and WARNING on page 14-1.

- 1. Turn key switch OFF and place the Forward/Reverse handle in NEUTRAL. Leave the batteries connected.
- 2. If battery pack voltage is below approximately 27 volts, the charger will not activate. The charger relay will have to be by-passed in order for the charger to activate.
- 3. Disconnect the DC cord from the charger receptacle and unplug the AC cord from the electrical outlet.
- 4. Remove the eight screws securing the charger cover and remove the cover from the charger.
- 5. Inside the charger, locate the two black wires connected to the contact terminals of the relay (Figure 14-13, Page 14-12).
- 6. Place a relay bypass wire (14 AWG minimum) between the two black wires (Figure 14-13, Page 14-12).
- 7. Plug the DC cord into the charger receptacle first, and then plug the AC cord into an electrical outlet.
- 8. The charger should activate and begin to charge the batteries. Allow the charger to operate for one or two hours. **See following WARNING**.

A WARNING

- DO NOT LEAVE THE VEHICLE UNATTENDED WHILE IT IS CHARGING. THE CHARGER OPERATING WITH A BYPASSED RELAY COULD SHORT CIRCUIT AND POSSIBLY CAUSE A FIRE.
- 9. After one or two hours, disconnect the charger AC cord from the electrical outlet *first*. Then disconnect the DC cord from the charger receptacle in the vehicle.
- Disconnect the relay bypass wire and connect the two black wires to the charger relay (Figure 14-13, Page 14-12).
- 11. Install the charger cover and the eight retaining screws.
- 12. Plug the DC cord into the charger receptacle and plug the AC cord into an electrical outlet.
- 13. Allow the charger to continue charging the batteries until the charger shuts of automatically.
- 14. When the charge cycle is complete, test the batteries again. If the battery pack voltage is above 27 volts and the vehicle will not operate, it will be necessary to troubleshoot the vehicle's electrical system to determine which electrical component has failed. See Section 11–Electrical System and Testing.

SECTION 15-MOTOR

A DANGER

- BATTERY EXPLOSIVE GASES! DO NOT SMOKE. KEEP SPARKS AND FLAMES AWAY.
 VENTILATE WHEN CHARGING OR USING IN AN ENCLOSED SPACE. ALWAYS WEAR FULL FACE SHIELD AND RUBBER GLOVES WHEN WORKING ON OR NEAR BATTERIES.
- USE EXTREME CAUTION WHEN USING TOOLS, WIRES, OR METAL OBJECTS NEAR BATTERIES! A SHORT CIRCUIT AND (OR) SPARK COULD CAUSE AN EXPLOSION.
- BATTERY POISON! CONTAINS ACID! CAUSES SEVERE BURNS. AVOID CONTACT WITH SKIN, EYES, OR CLOTHING. ANTIDOTES:
 - EXTERNAL: FLUSH WITH WATER. CALL A PHYSICIAN IMMEDIATELY.
 - INTERNAL: DRINK LARGE QUANTITIES OF MILK OR WATER. FOLLOW WITH MILK OF MAGNESIA OR VEGETABLE OIL. CALL A PHYSICIAN IMMEDIATELY.
 - EYES: FLUSH WITH WATER FOR FIFTEEN MINUTES. CALL PHYSICIAN IMMEDIATELY.

WARNING

- ONLY TRAINED TECHNICIANS SHOULD REPAIR OR SERVICE THIS VEHICLE. ANYONE DOING EVEN SIMPLE REPAIRS OR SERVICE SHOULD HAVE KNOWLEDGE AND EXPERIENCE IN ELECTRICAL AND MECHANICAL REPAIR.
- FOLLOW ALL PROCEDURES EXACTLY AS STATED IN THIS MANUAL, AND HEED ALL DANGER, WARNING AND CAUTION STATEMENTS, AS WELL AS THOSE AFFIXED TO THE VEHICLE.
- WEAR SAFETY GLASSES OR APPROVED EYE PROTECTION WHILE SERVICING VEHICLE.
- TURN KEY SWITCH **OFF**, PLACE FORWARD/REVERSE HANDLE IN THE **NEUTRAL** POSITION, AND REMOVE KEY PRIOR TO SERVICING.
- DO NOT WEAR LOOSE CLOTHING. REMOVE JEWELRY SUCH AS RINGS, WATCHES, CHAINS, ETC. BEFORE SERVICING VEHICLE.
- USE INSULATED TOOLS WHEN WORKING NEAR BATTERIES OR ELECTRICAL CONNECTIONS. USE EXTREME CAUTION TO AVOID SHORTING OF COMPONENTS OR WIRING.
- TO AVOID UNINTENTIONALLY STARTING THE VEHICLE, DISCONNECT BATTERIES AS SHOWN IN FIGURE 15-1, PAGE 15-1.

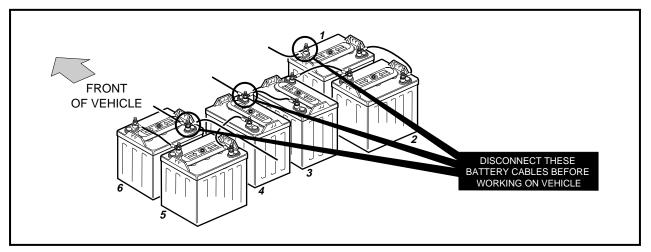


Figure 15-1 V-Glide 36-Volt Battery Configuration

MOTOR General Information

GENERAL INFORMATION

All DS V-Glide electric vehicles are equipped with 36-volt DC, series wound, reversible traction motors. If the motor should require major repair, it should be sent to a qualified motor repair shop. There are, however, many minor repairs that can be made by a trained technician.

EXTERNAL MOTOR TESTING

Using a multimeter or continuity tester, the following tests can be performed without disassembling the motor.

NOTE

TAG THE MOTOR WIRES FOR IDENTIFICATION BEFORE DISCONNECTING.

Test Procedure 1-Internal Short Circuits

Read DANGER and WARNING on page 15-1.

- 1. Disconnect batteries as shown (Figure 15-1, Page 15-1) and discharge the controller as instructed in WARNING on page 15-1.
- 2. Using two wrenches to prevent the posts from turning, disconnect wires from terminals on motor.
- 3. Using a multimeter set to 200 Ω (ohms), place the black (–) probe on the motor housing. Scratch through the paint to ensure a good connection. Place the red (+) probe on the A1, A2, S1, and S2 terminals respectively (Figure 15-2, Page 15-2). Multimeter should indicate no continuity. If the readings are incorrect, the motor will need to be removed from the vehicle and repaired by a qualified technician. See Motor Removal, Page 15-3.
 - 3.1. An incorrect reading from A1 or A2 terminal indicates three possible problems: a grounded A1 or A2 terminal, a grounded wire in the brush area, or a grounded armature/commutator. If the S1 or S2 reading is incorrect, it could be due to a grounded S1 or S2 terminal or a grounded field coil.

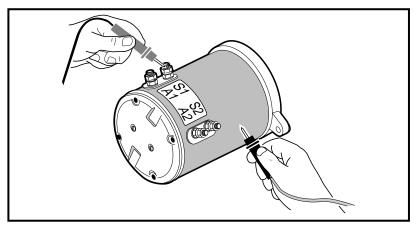


Figure 15-2 Test for Motor Short Circuits

Test Procedure 2–Armature Circuit Open

Read DANGER and WARNING on page 15-1.

- Disconnect the batteries as shown (Figure 15-1, Page 15-1) and discharge the controller as instructed in the WARNING on page 15-1.
- 2. Using two wrenches to prevent the post from turning, disconnect the wires from the A1 and A2 terminals. Using a multimeter set to 200 Ω (ohms), place the red (+) probe on the A1 terminal and the black (–) probe on the A2 terminal (**Figure 15-2, Page 15-2**). The multimeter should indicate continuity. If the

Motor

reading is incorrect, a possible open or poor contact in a brush assembly and/or open armature windings may be the cause. The motor will need to be removed from the vehicle and repaired by a qualified technician. **See Motor Removal**.

Test Procedure 3-Field Circuit Open

Read DANGER and WARNING on page 15-1.

- 1. Disconnect the batteries as shown (Figure 15-1, Page 15-1) and discharge the controller as instructed in the WARNING on page 15-1.
- 2. Using two wrenches to prevent the post from turning, disconnect the wires from the S1 and S2 terminals. Using a multimeter set to $200~\Omega$ (ohms), place the red (+) probe on the S1 terminal and the black (–) probe on the S2 terminal (Figure 15-2, Page 15-2). The reading should be continuity. If the reading is incorrect, there may be an open field coil or bad connections at terminals. Remove motor from vehicle and send to a qualified technician for repair. See Motor Removal.

MOTOR

Read DANGER and WARNING on page 15-1.

Motor Removal

- 1. Disconnect the battery cables, as shown (Figure 15-1, Page 15-1) and discharge the controller as instructed in the WARNING on page 15-1.
- 2. Using two wrenches to prevent the post from turning, disconnect wires from terminals on motor. Label the wires to ensure proper reconnection.
- 3. Slightly loosen all the lug nuts on both rear wheels.
- 4. Place floor jack under transaxle and raise rear of vehicle (Figure 15-3, Page 15-4) then place jackstands under frame cross-member between spring mount and side stringer, just forward of each rear wheel. Lower the vehicle to let the jackstands support the vehicle (Figure 15-4, Page 15-4). See following WARNING.

A WARNING

- LIFT ONLY ONE END OF THE VEHICLE AT A TIME. BEFORE LIFTING, LOCK THE BRAKES AND CHOCK THE WHEELS THAT REMAIN ON THE FLOOR. USE A SUITABLE LIFTING DEVICE (CHAIN HOIST OR HYDRAULIC FLOOR JACK) WITH 1000 LB. (454 KG.) MINIMUM LIFTING CAPACITY. DO NOT USE LIFTING DEVICE TO HOLD VEHICLE IN RAISED POSITION. ALWAYS USE APPROVED JACKSTANDS OF PROPER WEIGHT CAPACITY TO SUPPORT THE VEHICLE.
- 5. Remove both rear wheels.
- 6. Remove the nut, cup washer, and bushing from the bottom side of the shock absorber. Compress the shock absorber (pushing upwards) to move it out of the way.
- 7. Remove the nuts and bolts mounting the rear leaf springs to the shackles (Figure 15-5, Page 15-4).
- 8. To gain easier access to the motor, lower the transaxle as low as it will go. If more room is needed, remove the jack from beneath the transaxle and allow the springs to rest on the floor (Figure 15-5, Page 15-4).
- 9. Remove the four bolts that mount the motor to the transaxle.

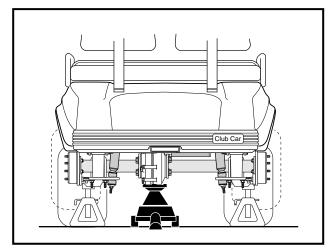
A CAUTION

• DO NOT PLACE FINGERS OR HANDS UNDER MOTOR DURING REMOVAL. SEVERE INJURY COULD RESULT IF FINGERS OR HANDS ARE CAUGHT BETWEEN MOTOR AND AXLE TUBE.

MOTOR Motor

Motor Removal, Continued:

10. Carefully slide the motor away from the transaxle until the motor spline disengages the input shaft. Remove the motor from the vehicle.



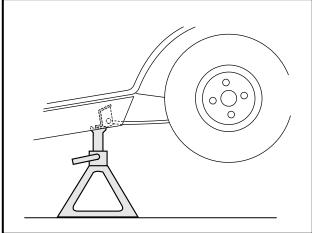


Figure 15-3 Lift Vehicle with Floor Jack

Figure 15-4 Support Vehicle on Jackstands

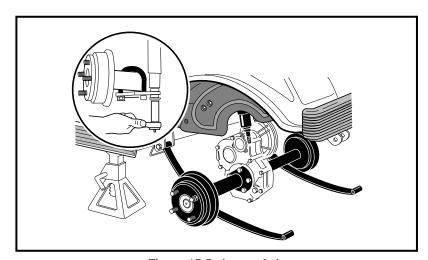
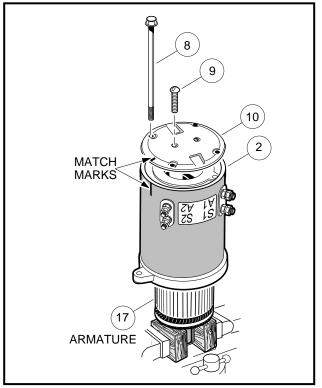


Figure 15-5 Lower Axle

Motor Disassembly

- 1. Before beginning disassembly, match mark motor end shield and stator shell. Place motor in a vice with wooden blocks as shown (Figure 15-6, Page 15-5). Read DANGER and WARNING on page 15-1.
- 2. Remove the four bolts (8) securing the end shield (10) to the stator shell (2) (Figure 15-6, Page 15-5).
- 3. Remove the two screws (9) attaching the end shield to the bearing retainer (Figure 15-6, Page 15-5).
- 4. Slide the armature (17) out of the opposite end of the stator shell (2) (Figure 15-6, Page 15-5).
- 5. Remove the two screws (11) attaching the brush rigging (12) to the stator shell (Figure 15-10, Page 15-8).
- 6. Mark the brush terminal posts (A1 and A2) (27, 28) to identify their positions in the stator shell. Remove the nuts (6) and flat washers (5) (Figure 15-10, Page 15-8). From the outside, push the posts through the stator shell wall and into the interior of the stator shell.
- 7. Carefully remove the brush rigging and the terminal posts from the stator shell.
- 8. To remove brush springs (14) from rigging, lift spring extensions out of and over the brush mounts and then slide the springs off their mounting tabs (Figure 15-7, Page 15-5).



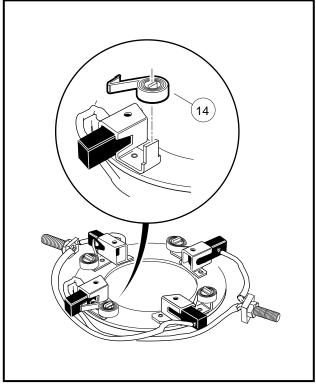


Figure 15-6 Motor Disassembly

Figure 15-7 Brush Spring Removal

TESTING AND INSPECTING INDIVIDUAL COMPONENTS

Read DANGER and WARNING on page 15-1.

ARMATURE

- 1. Disassemble the motor and carefully inspect the armature. Look for these characteristics:
- Burned, charred or cracked insulation.
- Improperly cured varnish.
- Thrown solder.
- · Flared armature windings.
- Damaged armature core laminations.
- · Worn, burned or glazed commutators.
- Dirty or oily commutators.
- · Raised commutator bars.
- · Worn armature bearing or shaft.

A dirty or oily commutator should be cleaned and wiped dry. Abnormalities identified during the inspection can help determine original cause of failure. Slight roughness of the commutator can be polished smooth with 400 grit or finer sandpaper. **See following CAUTION and NOTE.**

A CAUTION

• NEVER USE EMERY CLOTH TO POLISH THE COMMUTATOR. PARTICLES OF EMERY ARE CONDUCTIVE AND MAY SHORT-CIRCUIT THE COMMUTATOR BARS. NEVER USE OIL OR LUBRICANTS ON THE COMMUTATOR OR BRUSHES.

OIL ON THE COMMUTATOR MAY INDICATE A FAULTY TRANSAXLE INPUT SHAFT OIL SEAL.

Armature Ground Test

A CAUTION

DO NOT SUBMERGE THE ARMATURE IN SOLVENT.

NOTE

• BEFORE TESTING THE ARMATURE, WIPE IT CLEAN WITH A CLEAN CLOTH. REMOVE ANY CARBON DUST AND METAL PARTICLES FROM BETWEEN THE COMMUTATOR BARS.

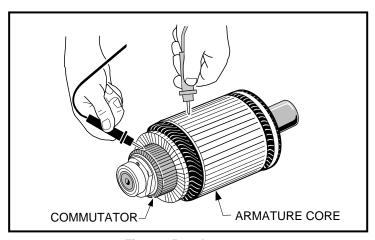


Figure 15-8 Armature

1. With multimeter set to 200 Ω (ohms), place one probe on commutator and the other on the armature core. The tester should indicate no continuity (Figure 15-8, Page 15-6). If reading is incorrect, replace the motor.

FIELD WINDINGS INSPECTION

Burned or scorched insulation on the field windings indicates the motor has overheated due to overloads or due to grounded or shorted coil windings. If the insulation on the windings is scorched, replace the motor or the stator shell assembly.

MOTOR COMPONENTS

- 1. Inspect the insulators (4 and 7) for cracks or other damage (Figure 15-10, Page 15-8).
- 2. Inspect brushes (13) for damage or excessive wear (Figure 15-10, Page 15-8). If brushes need to be replaced, see following NOTE.
- 3. Inspect brush springs (14) (Figure 15-10, Page 15-8). Replace discolored springs (light gold or blue tinted). Replace springs which apply a force of less than 16 oz. (Figure 15-11, Page 15-9).

CAUTION

• WHEN CHECKING BRUSH SPRING TENSION, DO NOT OVER-EXTEND THE SPRING. USING EXCESSIVE FORCE WILL DAMAGE THE SPRING.

- WHEN INSTALLING NEW BRUSHES, REMOVE AND REPLACE BRUSHES ONE AT A TIME. THIS
 METHOD ENSURES THE TERMINALS AND BRUSHES WILL BE PROPERLY POSITIONED IN
 THE RIGGING. SEE PAGE 15-10 FOR BRUSH INSTALLATION.
- ALWAYS REPLACE ALL FOUR BRUSHES. NEVER REPLACE ONLY TWO.
- INSTALL THE BRUSHES IN THE SAME RIGGING 180° FROM EACH OTHER.

BEARING INSPECTION

- 1. Using a clean cloth, wipe the carbon dust off the bearing. Inspect the bearing by spinning it by hand and checking for both axial (A) and radial (B) play (Figure 15-12, Page 15-9).
- Replace the bearing if it is noisy, does not spin smoothly, or has excessive play. Check the bearing and replace if rusted, worn, cracked, or if there is an abnormal color change in the metal of the bearing. Do not remove the bearing from the armature shaft unless it is to be replaced.

BEARING REMOVAL

Place the wedge attachment tool (Club Car Part No. 1012812) between the bearing (15) and the armature (17) (Figure 15-10, Page 15-8). Make sure the wedge attachment tool is supporting the inner race of the bearing. If a press is not available, secure a bearing puller (Club Car Part No. 1012811) to the bearing and pull the bearing off the end of the armature shaft. Support the shaft so it will not drop when the bearing is removed (Figure 15-9, Page 15-7). Discard the bearing.

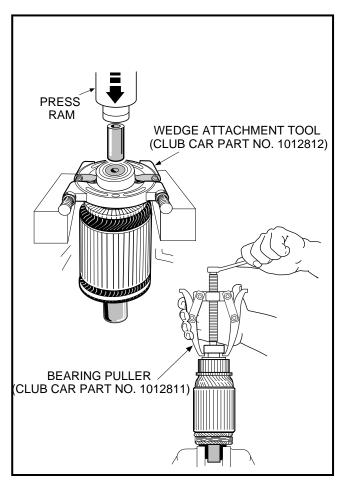


Figure 15-9 Bearing Removal

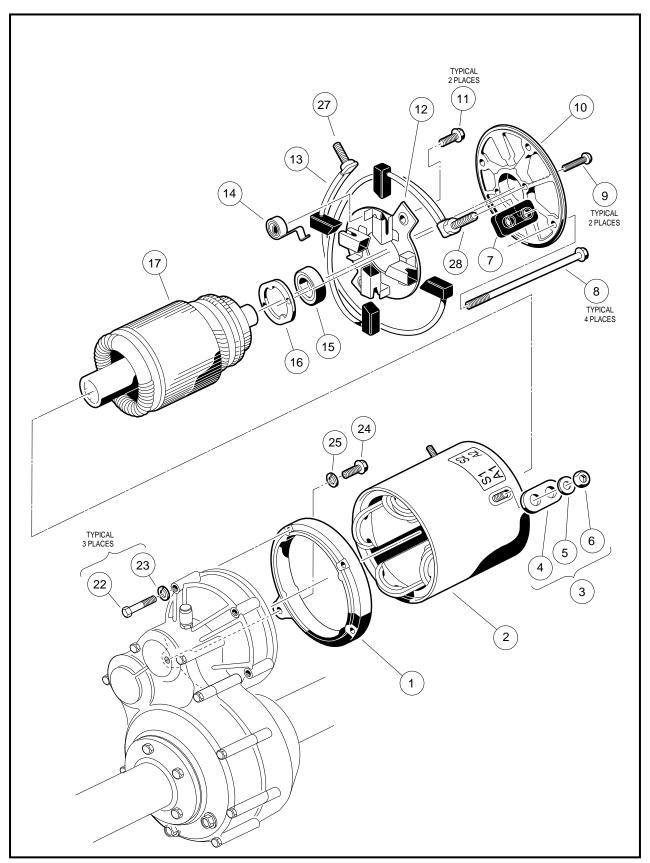


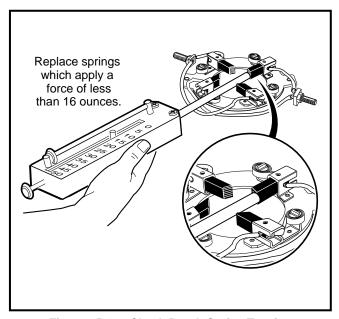
Figure 15-10 Motor

BEARING INSTALLATION

1. Press a new bearing (15) onto the armature. Use an arbor press that exerts pressure on the inner race only (Figure 15-10, Page 15-8). See following NOTE.

NOTE

- MAKE SURE THE BEARING RETAINER (16) (FIGURE 15-10, PAGE 15-8) IS POSITIONED ON THE ARMATURE SHAFT BEFORE THE BEARING IS PRESSED ONTO THE ARMATURE.
- USE AN ARBOR WITH AN OUTSIDE DIAMETER OF LESS THAN 5/8 INCH (16 MM) TO PRESS THE BEARING ONTO THE ARMATURE.



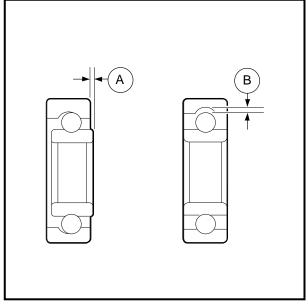


Figure 15-11 Check Brush Spring Tension

Figure 15-12 Inspect Bearing

RECONDITIONING THE MOTOR

Read DANGER and WARNING on page 15-1.

Motor reconditioning must be performed by a qualified motor repair technician. The use of proper tools and procedures is absolutely essential for successful motor reconditioning.

Motor Specifications

Any rework must be performed by a qualified technician. Motor service specifications are listed in the table below.

ITEM	SERVICE LIMIT
Commutator diameter (minimum)	2.265 inch (66.675 mm)
Commutator concentric with armature shaft within	.001 inch (0.0508 mm)
Limit depth of cut when machining commutator	.005 inch (0.127 mm)
Bar to bar run out should not exceed	.0002 inch (.00508 mm)
If undercut of segment insulator is less than .016 inch (0.406 mm), it should be undercut to	.031 inch (0.8 mm)
Machined face of Commutator	8-16 micro inches
Field coil resistance (V-Glide 36 volt, 2.97 Hp.)	0.00711 Ω (ohms)

MOTOR Motor Assembly

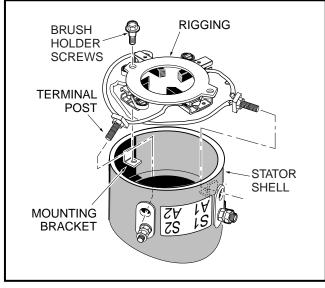
MOTOR ASSEMBLY

Read DANGER and WARNING on page 15-1.

- 1. If the bearing has been removed, replace the bearing:
 - 1.1. Press a new bearing (15) onto the armature. Use an arbor press that exerts pressure on the inner race only (Figure 15-10, Page 15-8). See NOTE following Bearing Installation on page 15-9.
- 2. Install the brushes. See NOTE on page 15-7.
 - 2.1. With brush rigging facing down and held slightly above the stator shell, insert the two terminal posts through the insulators in the stator shell wall at the A1 and A2 positions. Insert the brush holder screws through the rubber sealed holes in the rigging and into the threaded holes in the mounting bracket (Figure 15-13, Page 15-10). Tighten the screws to 20 in-lb (2.2 N-m).
 - 2.2. One at a time, push brush spring extensions back from brushes and slide the brushes back until they are completely retracted into their mounting slots. Then position the brush springs against the sides of the brushes so that spring pressure will hold them in the retracted position (Figure 15-7, Page 15-5).
 - 2.3. Slide the armature, bearing end first, into the stator shell. Make sure the brushes are held back while positioning the armature for proper commutator/brush contact. Release the brushes and place the springs outside the brushes so the brushes are being held against the commutator. See following CAUTION.

A CAUTION

• IF THE MOTOR IS BEING ASSEMBLED WITH THE ARMATURE STANDING ON END AS THE COMMUTATOR IS POSITIONED, MAKE SURE THE BRUSHES ARE HELD BACK. DO NOT ALLOW THE BRUSHES TO SUPPORT THE WEIGHT OF THE STATOR SHELL. THE BRUSHES CAN BE EASILY DAMAGED BY THIS WEIGHT.





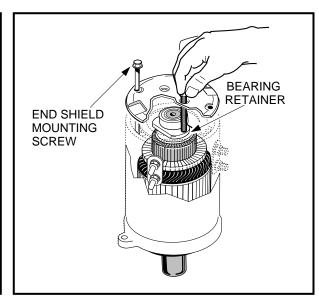


Figure 15-14 End Shield Installation

- 3. Install end shield onto the stator shell.
 - 3.1. Attach end shield (10) to bearing retainer (16). Align holes in bearing retainer with the two holes in end shield and install screws (9) (Figure 15-10, Page 15-8). Tighten screws to 17 in-lb (1.9 N-m).

• USE A LONG SCREW WITH THE SAME THREAD SPECIFICATIONS AS THE MOUNTING SCREWS TO MAINTAIN HOLE ALIGNMENT WHILE STARTING THE FIRST MOUNTING SCREW. SEE FIGURE 15-14, PAGE 15-10.

- 3.2. Align the match marks on the end shield and the stator shell. Install the four screws (8) **(Figure 15-10, Page 15-8)**. Tighten the screws to 90 in-lb (10 N-m).
- 4. Make sure the armature turns freely. If it does not turn freely, disassemble the motor to find the problem. Make sure the bearing is properly seated in the end shield when assembling the motor.

MOTOR INSTALLATION

Read DANGER and WARNING on page 15-1.

- 1. Thoroughly clean any existing grease from the motor coupling spline and the transaxle input shaft using CRC[®] Brakleen™ spray cleaner only.
- 2. Using a 1/4 inch wide flat-blade screwdriver, apply Nyogel PG-44A Damping Grease (Club Car part No. 102185301) to the transaxle input shaft splines, coating an area 1/4 to 3/8 inches wide from the tip end of the shaft. Be certain to fill all of the spline grooves within that area. Do not apply too much grease as this may cause difficulty when installing the motor.
- 3. Install the motor on the transaxle shaft, sliding it back and forth several times to distribute the lubricant.
- 4. Rotate the motor until the locating bolt mounting hole on the motor is aligned with its mounting hole in the transaxle case. Install the bolt (24) with lock washer (25). Do not tighten at this time (Figure 15-10, Page 15-8). See also Figure 15-15, Page 15-12.
- 5. Install, but do not tighten the three bolts (22) with lock washers (23) that mount the motor to the transaxle (Figure 15-10, Page 15-8). See following CAUTION.

A CAUTION

- MAKE SURE THE MOTOR IS PROPERLY SEATED ON THE TRANSAXLE HOUSING.
- 6. Finger tighten the four bolts, moving from bolt (C) to bolts (A, B, and D) until the motor is seated. With one wheel jacked up so it is off the ground, rotate the axle to make sure the motor is not binding on the transaxle input shaft (Figure 15-16, Page 15-12). See following NOTE.

NOTE

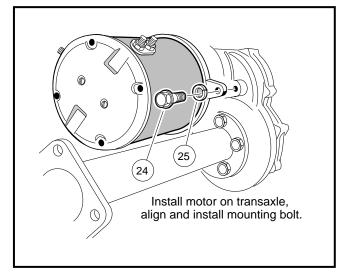
- FAILURE TO TIGHTEN THE MOTOR MOUNTING BOLTS TO THE PROPER TORQUE AND IN THE PROPER SEQUENCE CAN RESULT IN MOTOR NOISE DURING OPERATION.
- 7. Using a torque wrench, tighten the lower 1/4 inch bolt (C). Now tighten the bolt (A), then tighten the center bolt (B) at the top. Tighten these bolts to 65 in-lb (7.3 N-m). Tighten the bolt (D) to 155 in-lb (17.5 N-m) (Figure 15-16, Page 15-12).
- 8. Install the motor wires, making sure they are connected to the correct terminals. Tighten the terminal retaining nuts to 65 in-lb (7.3 N-m). **See following NOTE**.

NOTE

• IF MOTOR WIRES WERE NOT TAGGED FOR IDENTIFICATION BEFORE BEING DISCONNECTED, SEE WIRING DIAGRAM, **SECTION 11**, **FIGURE 11-3**, **PAGE 11-4**.

MOTOR Motor Installation

Motor Installation, Continued:



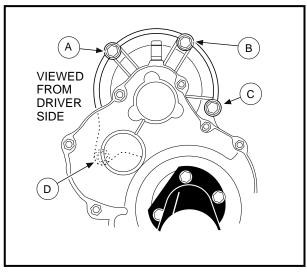


Figure 15-15 Motor Installation

Figure 15-16 Motor Mount

- 9. With a floorjack, lift the transaxle while, at the same time, guiding the leaf springs into the shackles. See Section 9–Rear Suspension, in the appropriate Maintenance and Service Manual.
- 10. Insert the mounting bolts through the spring shackles and the bushings in the leaf spring eyes and install lock nuts. Tighten the bolts to 23 ft-lb. (31 N-m). See Section 9–Rear Suspension, in the appropriate Maintenance and Service Manual.
- 11. Install the shock absorbers. See Section 9–Rear Suspension, in the appropriate Maintenance and Service Manual.
- 12. Install the wheels and finger tighten lug nuts.
- 13. Lift vehicle and remove jackstands. Lower vehicle to the floor and tighten lug nuts (using a criss-cross pattern) to 55 ft-lb (74.6 N-m).
- 14. Connect battery cables (positive cable first) and tighten to 110 in-lb (12.4 N-m). Coat terminals with Battery Protector Spray (Club Car Part No. 1014305) to minimize corrosion (Figure 15-1, Page 15-1).

SECTION 16-TRANSAXLE

A DANGER

- BATTERY EXPLOSIVE GASES! DO NOT SMOKE. KEEP SPARKS AND FLAMES AWAY. VENTILATE WHEN CHARGING OR USING IN AN ENCLOSED SPACE. ALWAYS WEAR FULL FACE SHIELD AND RUBBER GLOVES WHEN WORKING ON OR NEAR BATTERIES.
- USE EXTREME CAUTION WHEN USING TOOLS, WIRES, OR METAL OBJECTS NEAR BATTERIES! A SHORT CIRCUIT AND (OR) SPARK COULD CAUSE AN EXPLOSION.
- BATTERY POISON! CONTAINS ACID! CAUSES SEVERE BURNS. AVOID CONTACT WITH SKIN, EYES, OR CLOTHING. ANTIDOTES:
 - EXTERNAL: FLUSH WITH WATER. CALL A PHYSICIAN IMMEDIATELY.
 - INTERNAL: DRINK LARGE QUANTITIES OF MILK OR WATER. FOLLOW WITH MILK OF MAGNESIA OR VEGETABLE OIL. CALL A PHYSICIAN IMMEDIATELY.
 - EYES: FLUSH WITH WATER FOR FIFTEEN MINUTES. CALL PHYSICIAN IMMEDIATELY.

A WARNING

- ONLY TRAINED TECHNICIANS SHOULD REPAIR OR SERVICE THIS VEHICLE. ANYONE DOING EVEN SIMPLE REPAIRS OR SERVICE SHOULD HAVE KNOWLEDGE AND EXPERIENCE IN ELECTRICAL AND MECHANICAL REPAIR.
- FOLLOW ALL PROCEDURES EXACTLY AS STATED IN THIS MANUAL, AND HEED ALL DANGER, WARNING AND CAUTION STATEMENTS, AS WELL AS THOSE AFFIXED TO THE VEHICLE.
- WEAR SAFETY GLASSES OR APPROVED EYE PROTECTION WHILE SERVICING VEHICLE.
- TURN KEY SWITCH **OFF**, PLACE FORWARD/REVERSE HANDLE IN THE **NEUTRAL** POSITION, AND REMOVE KEY BEFORE SERVICING THE VEHICLE.
- MOVING PARTS! DO NOT ATTEMPT TO SERVICE THE VEHICLE WHILE IT IS RUNNING.
- USE INSULATED TOOLS WHEN WORKING NEAR BATTERIES OR ELECTRICAL CONNECTIONS. USE EXTREME CAUTION TO AVOID SHORTING OF COMPONENTS OR WIRING.
- LIFT ONLY ONE END OF THE VEHICLE AT A TIME. BEFORE LIFTING, LOCK THE BRAKES
 AND CHOCK THE WHEELS THAT REMAIN ON THE FLOOR. USE A SUITABLE LIFTING
 DEVICE (CHAIN HOIST OR HYDRAULIC FLOOR JACK) WITH 1000 LB. (454 KG.) MINIMUM
 LIFTING CAPACITY. DO NOT USE LIFTING DEVICE TO HOLD VEHICLE IN RAISED POSITION.
 ALWAYS USE APPROVED JACKSTANDS OF PROPER WEIGHT CAPACITY TO SUPPORT THE
 VEHICLE.
- TO AVOID UNINTENTIONALLY STARTING VEHICLE, DISCONNECT BATTERIES AS SHOWN IN SECTION 11, FIGURE 11-1, PAGE 11-1.

GENERAL INFORMATION

There are two types of transaxles used in the manufacture of the electric vehicle. The different transaxles are identified by the orientation of the gear case bolt heads. The Type G transaxle has gear case bolt heads oriented toward the passenger side of the vehicle. The Type K transaxle has gear case bolt heads oriented toward the driver side of the vehicle. Please note that parts used in these transaxles are not interchangeable with one another. Service and repair procedures specific to each transaxle are noted throughout this section.

TRANSAXLE

LUBRICATION

There are two plugs located on the lower half of the transaxle housing. The upper plug (as viewed when the vehicle is on a level surface), is used as a lubricant level indicator. When the vehicle is parked on a level surface, the lubricant level should be even with the bottom of the hole. The lower plug is for draining the lubricant. When draining the lubricant, the upper plug should be removed so the lubricant will drain faster. Be sure the drain plug is reinstalled before filling.

NOTE

 RECYCLE OR DISPOSE OF USED OIL OR LUBRICANT IN ACCORDANCE WITH LOCAL, STATE AND FEDERAL REGULATIONS.

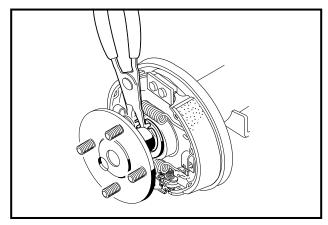
AXLE BEARING AND SHAFT

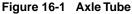
Read DANGER and WARNING on page 16-1.

AXLE SHAFT

Axle Shaft and Oil Seal Removal

- 1. Place chocks at the front wheels. Loosen lug nuts on rear wheels and lift the rear of the vehicle with a chain hoist or floor jack. Place jackstands under the axle tubes to support the vehicle.
- 2. Remove the rear wheel and brake drum. See Section 6-Wheel Brake Assemblies and Section 8-Wheels and Tires in the appropriate Maintenance and Service Manual.
- 3. Using 90° internal snap ring pliers, remove the internal retaining ring (6) from the axle tube (Figures 16-3 or 16-4, Pages 16-3 or 16-4). See also Figure 16-1, Page 16-2.
- 4. Remove the axle, retaining ring, and bearing assembly by pulling the axle straight out of the housing.





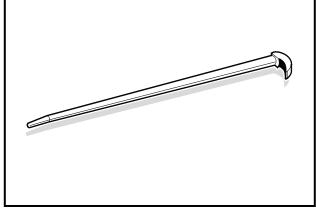


Figure 16-2 Rolling Wedge Bar

5. Use a 16 inch (40 cm) rolling wedge bar (Figure 16-2, Page 16-2) to remove oil seal. Insert wedge bar underneath the seal lip and pry out oil seal (17) (Figure 16-5, Page 16-5). See following CAUTION.

A CAUTION

- DO NOT SCAR OR DAMAGE THE INSIDE SURFACES OF THE TUBE WHEN REMOVING THE OIL SEAL. A DAMAGED TUBE MIGHT HAVE TO BE REPLACED.
- 6. Inspect the axle shaft assembly to be sure the bearing and collar have not slipped and are still seated against the shoulder on the axle shaft.

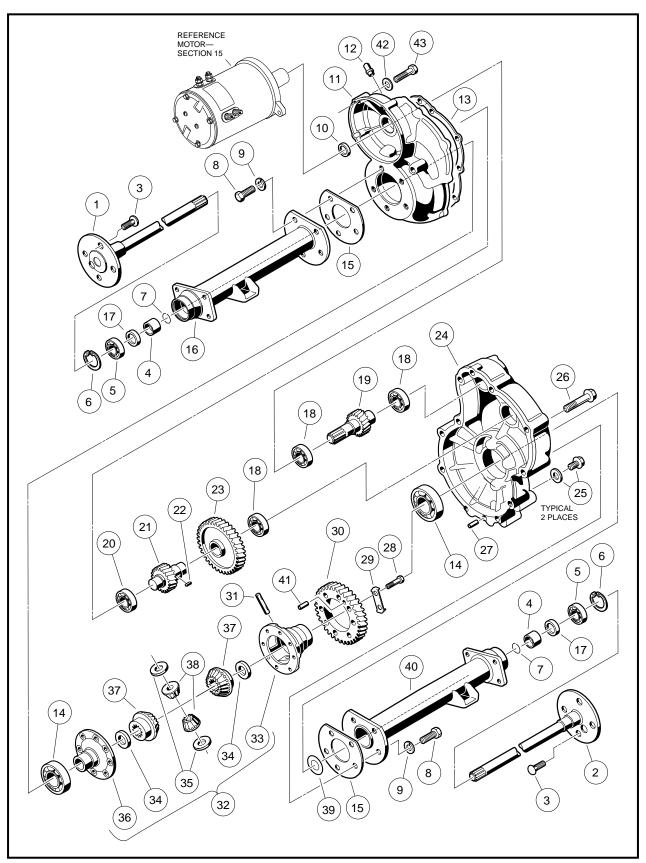


Figure 16-3 Transaxle - Type K

16 TRANSAXLE Axle Bearing and Shaft

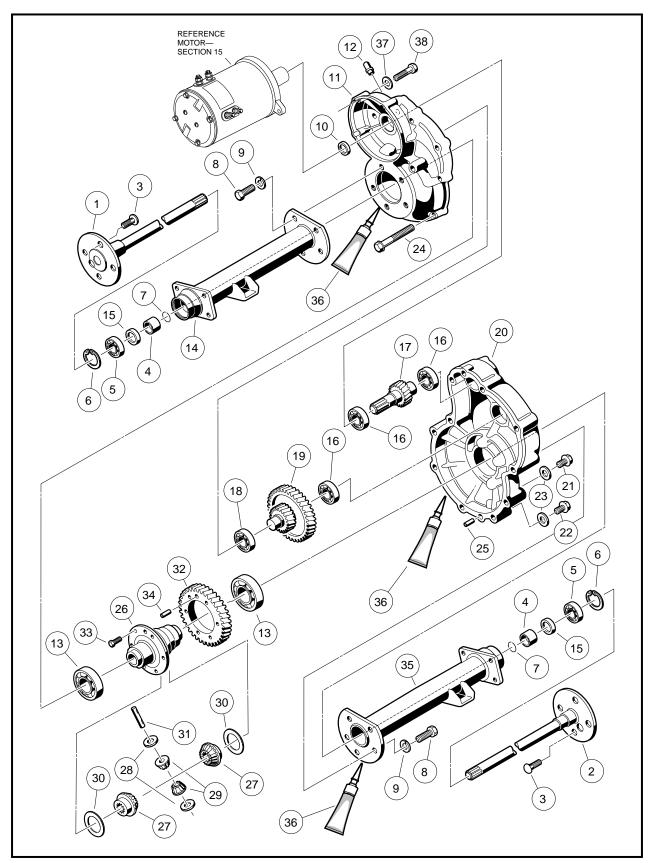


Figure 16-4 Transaxle - Type G

Axle Shaft and Oil Seal Removal, Continued:

7. Inspect bearing (5) (Figure 16-3, Page 16-3 or Figure 16-4, Page 16-4). If the bearing in a Type K transaxle is worn or damaged, replace bearing. If the bearing in a Type G transaxle is worn or damaged, see NOTE at Axle Bearing on Page 16-5.

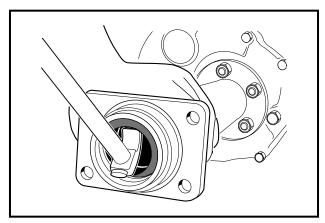


Figure 16-5 Seal Lip

AXLE BEARING

NOTE

• DO NOT REMOVE AXLE BEARING FROM A TYPE G TRANSAXLE. IF BEARING IS WORN OR DAMAGED, THE ENTIRE AXLE ASSEMBLY (1 OR 2) MUST BE REPLACED (FIGURE 16-4, PAGE 16-4).

Axle Bearing Removal (Type K Transaxle Only)

- 1. Remove the retaining ring (7) from the axle shaft (Figure 16-3, Page 16-3).
- 2. Place a bearing puller wedge attachment (Club Car Part No. 1012812) on the axle shaft between the wheel mounting flange and the bearing.
- 3. Press bearing (5) and collar (4) off together (Figure 16-6, Page 16-5).

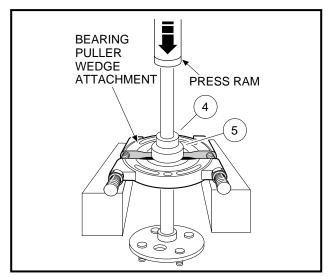


Figure 16-6 Bearing and Collar

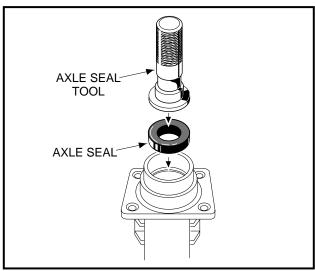


Figure 16-7 Axle Seal Tool

16 TRANSAXLE Axle Bearing and Shaft

A CAUTION

• DO NOT TIGHTEN THE BEARING PULLER WEDGE ATTACHMENT AGAINST THE AXLE SHAFT. THIS COULD DAMAGE THE AXLE SHAFT WHEN PRESSING OFF THE BEARING AND COLLAR.

NOTE

IT MAY BE NECESSARY TO HEAT THE COLLAR BEFORE THE COLLAR CAN BE REMOVED.

Axle Bearing Installation (Type K Transaxles Only)

- 1. If removed, place retaining ring (6) on axle shaft (1 or 2) **(Figure 16-3, Page 16-3).** The retaining ring will be loose on the axle shaft until it is installed into the axle tube.
- 2. Apply two drops of Loctite[®] 271 to the inside of the collar.

A CAUTION

- APPLY LOCTITE[®] 271 TO INSIDE OF COLLAR ONLY, NOT TO THE SHAFT, SO THE LOCTITE WILL BE PUSHED AWAY FROM THE BEARING AS THE COLLAR AND BEARING ARE PRESSED ON. IF LOCTITE GETS ON OR IN THE BEARING, THE BEARING MUST BE REPLACED.
- THE COLLAR SHOULD BE REMOVED NO MORE THAN TWO TIMES. IF A BEARING IS REMOVED A THIRD TIME, THE SHAFT AND COLLAR WILL NOT GIVE A PROPER FIT.
- 3. Place the bearing and the collar on the shaft (note, this is a sealed bearing). See following CAUTION.

A CAUTION

- IF THE BEARING WAS REMOVED FROM THE SHAFT, REPLACE BEARING WITH A NEW ONE.
- 4. Place the bearing puller wedge attachment against the collar and press on both the bearing and collar. **See CAUTION on page 16-6.**
- 5. Install retaining ring (7) into the groove on the axle shaft (Figure 16-3, Page 16-3).

Axle Shaft and Oil Seal Installation

- 1. Clean bearing and seal seats in the axle tube (16 or 40) (Figure 16-3, Page 16-3) or (14 or 35) (Figure 16-4, Page 16-4).
- Place a new seal (17) (Figure 16-3) or (15) (Figure 16-4) in the axle tube with the seal lip facing away from the bearing. Use an axle seal tool (Club Car Part No. 1014162) and mallet to tap it in until it seats firmly in position (Figure 16-7, Page 16-5). A hydraulic press may also be used with the axle seal tool.
- 3. Clean the shaft splines and then insert the shaft, splined end first, through the seal and into the axle tube. Be careful not to damage the seal. Then advance the shaft through the inner bearing and rotate it to align the shaft splines with the splined bore of the differential side gear. Continue advancing the shaft until the bearing seats against the axle tube shoulder.
- Using snap ring pliers, install retaining ring (6) inside axle tube (Figure 16-3 or 16-4, Pages 16-3 or 16-4).
 See following NOTE.

NOTE

• TYPE G TRANSAXLES: IF RETAINING RING (6) MUST BE REPLACED, THE ENTIRE AXLE SHAFT ASSEMBLY (1 OR 2) MUST BE REPLACED (FIGURE 16-4, PAGE 16-4).

5. Place a 1/4 inch to 3/8 inch (6 to 10 mm) diameter rod against the retaining ring and tap lightly at four to five locations around the retaining ring to ensure it is properly seated. **See following WARNING.**

WARNING

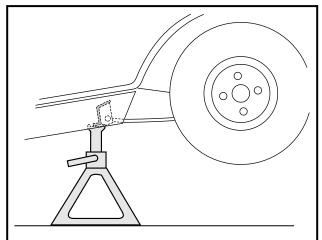
BE SURE THE RETAINING RING IS PROPERLY SEATED IN ITS GROOVE. IF THE RING IS NOT
PROPERLY INSTALLED, THE AXLE ASSEMBLY WILL SEPARATE FROM THE TRANSAXLE AND
DAMAGE THE AXLE ASSEMBLY AND OTHER COMPONENTS. LOSS OF VEHICLE CONTROL
COULD RESULT, CAUSING SEVERE PERSONAL INJURY.

TRANSAXLE

Read DANGER and WARNING on page 16-1.

TRANSAXLE REMOVAL

- 1. Place chocks at the front wheels and slightly loosen the lug nuts on both rear wheels.
- 2. Place floor jack under transaxle and raise rear of vehicle (Figure 16-8, Page 16-7) then place jackstands under frame cross-member between the spring mount and the side stringer, just forward of each rear wheel. Lower the vehicle to let the jackstands support the vehicle.
- 3. Remove the rear wheels, then thread one lug nut onto a stud on each rear hub. This will keep the brake drums on the hubs.
- 4. Remove the cotter pins (1), brake cable clevis pins (2), and cable retaining E-clips (3). Disconnect the brake cables (4) (Figure 16-9, Page 16-7).
- 5. Disconnect the shock absorbers from their lower mounts (Figure 16-13, Page 16-9).



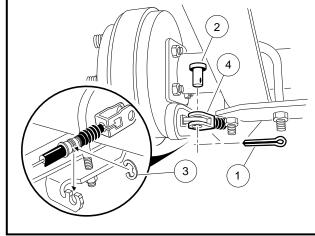


Figure 16-8 Support Vehicle on Jackstands

Figure 16-9 Disconnect Brakes

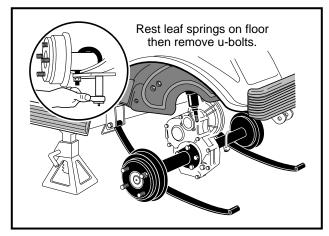
- 6. Disconnect the four motor wires. Use two wrenches to prevent the post from turning.
- 7. With a floor jack supporting the transaxle, remove lower spring shackle nuts and bolts. Position shackles so they are clear of springs (Figure 16-14, Page 16-9).
- 8. If a chain hoist was used to raise the vehicle, lift the vehicle high enough to permit easy access and clearance for removal of the motor. If a floor jack was used to raise the vehicle, lower the transaxle enough to permit easy access and clearance for removal of the motor.
- 9. Remove the three motor mounting bolts (Figure 16-11, Page 16-8), and the motor positioning bolt (Figure 16-12, Page 16-8) mounting the motor to the transaxle. See following WARNING.

6 TRANSAXLE Transaxle

Transaxle Removal, Continued:

A WARNING

• DO NOT POSITION FINGERS UNDER MOTOR WHEN SLIDING OFF INPUT SHAFT IN STEP 9. FINGERS MAY GET PINCHED WHEN MOTOR DISENGAGES.



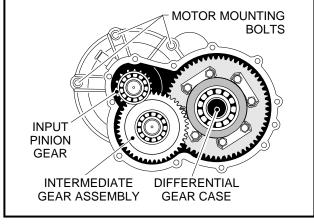


Figure 16-10 Leaf Springs

Figure 16-11 Motor Mounting Bolts

- 10. Carefully remove the motor from the transaxle. Slide the motor away from the transaxle until the motor spline becomes disengaged from the input shaft, then lift motor out. **See preceding WARNING.**
- 11. If a floorjack was used, pull floorjack from beneath the transaxle and allow the springs to rest on the floor.
- 12. Remove the U-bolts attaching the transaxle to the leaf springs (Figure 16-10, Page 16-8).
- 13. Carefully lift each end of the transaxle off its positioning pin (on the leaf spring) and slide the transaxle to the rear and out of the vehicle.
- 14. Drain the lubricant from the transaxle and remove the axle shafts as instructed on page 16-2. **See also NOTE on page 16-2.**
- 15. If removal of the brake assemblies is required, see Section 6–Wheel Brake Assemblies in the Maintenance and Service Manual.

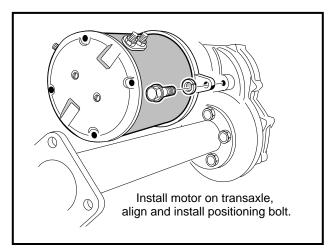
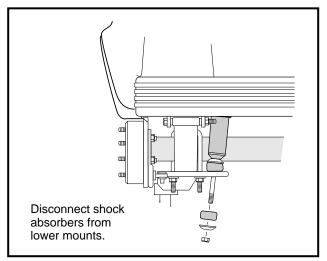


Figure 16-12 Motor Positioning Bolt



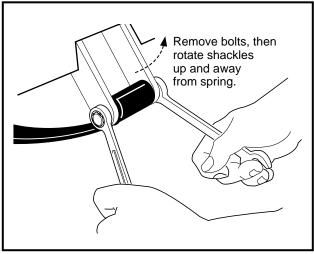


Figure 16-13 Disconnect Shocks

Figure 16-14 Shackles

TRANSAXLE DISASSEMBLY, INSPECTION AND ASSEMBLY

Read DANGER and WARNING on page 16-1.

TRANSAXLE DISASSEMBLY AND INSPECTION

1. To detach axle tubes (16 and 40) (Figure 16-3, Page 16-3) or (14 and 35) (Figure 16-4, Page 16-4) from the transaxle housing, remove the bolts and lock washers (8 and 9) (Figure 16-3 or 16-4).

NOTE

- TYPE K TRANSAXLES ONLY: SHIMS ARE LOCATED BETWEEN AXLE TUBE AND DIFFERENTIAL CASE BEARING. DO NOT DAMAGE SHIMS. IF SHIMS ARE REMOVED, SET THEM ASIDE FOR REINSTALLATION.
- 2. Remove 10 bolts (26) (Figure 16-3, Page 16-3) or 11 bolts, (24) (Figure 16-4, Page 16-4) that hold housing together.
- 3. Pull the halves of the housing apart. If necessary, tap lightly on the spline of the input pinion.

A CAUTION

- TO PREVENT DAMAGE TO THE HOUSING MATING SEAL SURFACES, USE CAUTION WHEN SEPARATING HALVES.
- 4. Remove input pinion gear by pulling gear (19) (Figure 16-3, Page 16-3) or (17) (Figure 16-4, Page 16-4) out while rocking intermediate gear assembly. Lift intermediate gear assembly and differential gear case unit out simultaneously.

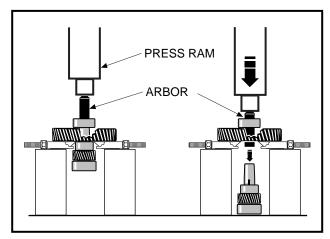
A CAUTION

- DO NOT DAMAGE GEARS. USE EXTREME CARE WHEN HANDLING THEM.
- 5. Use a bearing puller or arbor press to remove bearings (18) (Figure 16-3, Page 16-3) or (16) (Figure 16-4, Page 16-4) from the input pinion gear. If the oil seal (10) is damaged, replace it (Figures 16-3 or 16-4, Pages 16-3 or 16-4). See also Figure 16-15, Page 16-10. See following CAUTION.

Transaxle Disassembly and Inspection, Continued:

A CAUTION

DO NOT REUSE BEARINGS AFTER REMOVING THEM. REPLACE BEARINGS WITH NEW ONES.



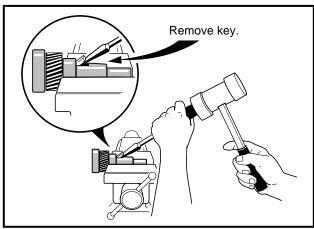
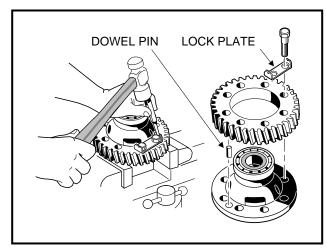


Figure 16-15 Intermediate Gear Assembly

Figure 16-16 Remove Key

- 6. To disassemble the intermediate gear assembly, press off together the bearing (18) (Figure 16-3, Page 16-3) or (16) (Figure 16-4, Page 16-4) and the gear (23) (Figure 16-3, Page 16-3) or (19) (Figure 16-4, Page 16-4). See also Figure 16-15, Page 16-10.
- 7. Type K transaxles: Remove key (22) (Figure 16-3, Page 16-3). See also Figure 16-16, Page 16-10.
- 8. Press the bearing (20) (Figure 16-3, Page 16-3) or (18) (Figure 16-4, Page 16-4) off the intermediate gear assembly.





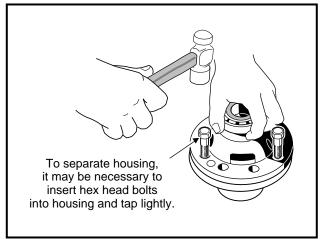
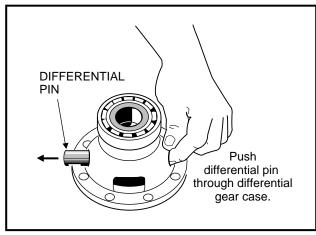


Figure 16-18 Separate Housing

- 9. Disassemble the differential gear case:
 - 9.1. Type K transaxles: Bend the bolt lock plates (29) down onto the ring gear (30) (Figure 16-3, Page 16-3). See also Figure 16-17, Page 16-10.
 - 9.2. Remove eight hex bolts (28) (Figure 16-3, Page 16-3) or four hex bolts, (33) (Figure 16-4, Page 16-4), that secure the ring gear to the differential case.
 - 9.3. Remove the ring gear. Retain dowel pin from between ring gear and differential case for reassembly.

- 9.4. Separate the differential gear case housing. If necessary, reinstall two of the hex bolts (removed previously in step 9.2.) into the differential gear unit and, while holding the unit slightly above the work area, lightly tap the bolt heads (**Figure 16-18**, **Page 16-10**). Remove the two bolts.
- 9.5. Remove the differential pin (31) by pushing pin through differential gear case from one side (Figures 16-3 or 16-4, Pages 16-3 or 16-4). See also Figure 16-19, Page 16-11.



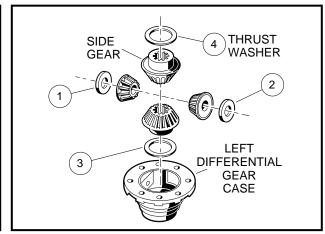


Figure 16-19 Differential Pin

Figure 16-20 Left Differential

- 9.6. Remove the idler gears and thrust plates (38 and 35), (Figure 16-3, Page 16-3) or (29 and 28) Figure 16-4, Page 16-4).
- 9.7. Remove the differential gears and thrust plates (34 and 37) (Figure 16-3, Page 16-3) or (30 and 27) (Figure 16-4, Page 16-4). See also Figure 16-20, Page 16-11.
- 9.8. Inspect the bearings (14) (Figure 16-3, Page 16-3) or (13) (Figure 16-4, Page 16-4) of the differential case and replace them if they are damaged. To remove them, press them off. See CAUTION at bottom of page 16-10.
- 10. Inspect parts for wear or damage. Any worn or damaged parts should be replaced. See following NOTE.

DAMAGED OR WORN GEARS SHOULD BE REPLACED AS SETS.

TRANSAXLE ASSEMBLY

A CAUTION

- DO NOT PRESS AGAINST THE BEARING OUTER RACE.
- TYPE K TRANSAXLES: GASKET (13) FACES OF THE HOUSING MUST BE CLEAN AND SMOOTH. USE ONLY A NEW GASKET THAT IS NOT TORN OR DAMAGED. THE GASKET MUST LIE FLAT AGAINST THE HOUSING FACES (FIGURE 16-3, PAGE 16-3).
- THE HOUSING AND ALL PARTS MUST BE WIPED CLEAN AND DRY BEFORE REASSEMBLY.
- 1. If bearings (14) (Figure 16-3, Page 16-3) or (13) (Figure 16-4, Page 16-4) were removed during disassembly, install new bearings using an arbor press.
- 2. Assemble the differential gear case.
 - 2.1. Install the pin (31) (Figures 16-3 or 16-4, Pages 16-3 or 16-4). Apply a small amount of oil to all thrust plates and to both ends of the pin.

• Type K transaxles:

- 2.2. While aligning the dowel pin, assemble the two halves of the differential gear case (33 and 36) and reinstall the output gear (30) (Figure 16-3, Page 16-3).
- Install eight hex bolts (28) and the bolt lock plates (29) (Figure 16-3, Page 16-3). Tighten the bolts to 18 ft-lb (24 N-m).
- 2.4. Bend the edges of the bolt locking tabs securely against the flats of the bolt heads to prevent the bolts from loosening and possibly causing damage (Figure 16-17, Page 16-10).
- 2.5. If the large gear (23) was removed from the intermediate gear, insert key (22) into keyway in the shaft and then press the large gear and the bearing (18) onto the shaft. Be sure the key is properly positioned in the keyway before attempting to press on the large gear and bearing (Figure 16-3, Page 16-3).

Type G transaxles:

2.6. Install four hex bolts (33) and output gear (32). Tighten bolts to 51 ft-lb (69 N-m) (Figure 16-4, Page 16-4).

· All transaxles:

- 3. Press a new bearing (20) (Figure 16-3, Page 16-3) or (18) (Figure 16-4, Page 16-4) onto the intermediate gear assembly.
- 4. Press new bearing (18) (Figure 16-3, Page 16-3) or (16) (Figure 16-4, Page 16-4) onto input pinion gear.
- 5. Apply grease to the lip of the new oil seal (10) (Figures 16-3 or 16-4, Pages 16-3 or 16-4) and install the seal using a transaxle pinion seal tool (Club Car Part No. 1014161). The lip of the oil seal should face the inside of the transaxle housing. Make sure the seal is firmly seated.
- 6. Install the differential assembly, the intermediate gear assembly, and the input pinion gear simultaneously. Be sure all bearings are seated properly in the housing. Rotate the input shaft to check for smooth gear operation (Figure 16-11, Page 16-8).
- 7. Install both dowel pins (27) (Figure 16-3, Page 16-3) or (25) (Figure 16-4, Page 16-4) in the transaxle housing (24 or 20).
- 8. Install left half of transaxle housing:

• For Type K transaxles:

- 8.1. Place a new gasket (13) **(Figure 16-3, Page 16-3)** in position on the mating face of the housing. Use the dowel pins to position the gasket. Make sure all holes are aligned.
- 8.2. Install left half of transaxle housing (24) (Figure 16-3, Page 16-3).
- 8.3. Install the ten bolts (26) and tighten to 69 in-lb (7.8 N-m) (Figure 16-3, Page 16-3).
- 8.4. If the axle tube (16 and 40) was removed, install the shims (39), (if the shims were removed) and a new gasket. Install the axle tube with five lock washers and bolts (9 and 8) (Figure 16-3, Page 16-3). Tighten the bolts to 22 ft. lb (30 N-m).

NOTE

• TYPE K TRANSAXLES: IF THE DIFFERENTIAL CASE (33 AND 36), THE TRANSAXLE HOUSING (11 AND 24) OR AXLE TUBE (16 AND 40) (FIGURE 16-3, PAGE 16-3) WAS REPLACED, SEE SHIMMING THE TRANSAXLE ON PAGE 16-13.

• For Type G transaxles:

- 8.1. Place 1/8 inch bead of three bond liquid gasket on mating face of housing. See following NOTE.
- 8.2. Install left half of transaxle housing (20) (Figure 16-4, Page 16-4).
- 8.3. Install eleven bolts in the case housing and tighten to 19 ft-lb (25.7 N-m). Type G transaxles have no shims or gasket.

- TYPE G TRANSAXLES DO NOT USE A GASKET ON THE MATING FACE OF THE HOUSING. USE AN 1/8 INCH BEAD OF THREE BOND LIQUID GASKET INSTEAD.
 - 8.4. Install axle tube with lock washers and bolts (9 and 8) (Figure 16-4, Page 16-4). Tighten the bolts to 36 ft-lb (49 N-m).

• For all transaxles:

- 9. Install the brake assemblies as instructed in Section 6-Wheel Brake Assemblies.
- 10. Apply a small amount of grease to the lip of the oil seal (17) (Figure 16-3, Page 16-3) or (15) (Figure 16-4, Page 16-4).
- 11. Clean the splines on the axle shaft (1 and 2). Rotate the axle to align the shaft splines with the splined bore of the differential side gear. Push the shaft in until the bearing seats against the shoulder in the axle tube (Figures 16-3 and 16-4, Pages 16-3 and 16-4).
- 12. Install the retaining ring (6) (Figures 16-3 and 16-4, Pages 16-3 and 16-4) in the axle tube. See WARNING on page 16-7.
- 13. Make sure the drain plug is installed in the transaxle and tightened to 23 ft-lb (31 N-m). Fill the transaxle, through the level indicator hole, with 22 ounces of SAE 30 API Class SE, SF, or SG oil (a higher grade may also be used). Install and tighten the level indicator plug to 23 ft-lb (31 N-m).

SHIMMING THE TRANSAXLE

Type K Transaxles Only

If the differential case (36 and 33), transaxle housing (11 and 24), or axle tube (16 and 40) has been replaced, the transaxle may need new shims. To determine whether new shims are necessary, the transaxle must be completely assembled except for the short axle tube (16) and both axle shafts (1 and 2) (Figure 16-3, Page 16-3).

- 1. Stand the transaxle on end, on the axle tube.
- 2. Using a depth gauge, measure the distance from the gasket seal surface of the axle tube (gasket must be removed) to the outer race of the bearing (14) on the differential case assembly (32) (Figure 16-3, Page 16-3). See also Figure 16-21, Page 16-13.

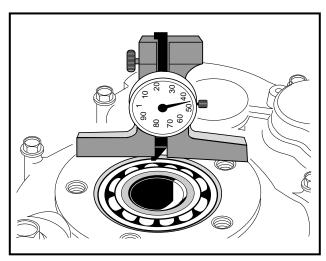


Figure 16-21 Depth Gauge

6 TRANSAXLE Transaxle Installation

Shimming the Transaxle, Continued:

3. Use the following charts to determine whether shimming is required and, if so, how many shims (Club Car Part No. 1013781) should be used.

Distance from gasket seal surface to outer race or bearing - INCHES (MM)	SHIMS REQUIRED
Up to .134 inches (3.4 mm)	0
.134142 inches (3.4 - 3.6 mm)	1
.142150 inches (3.6 - 3.8 mm)	2
.150155 inches (3.8 - 3.9 mm)	3

TRANSAXLE INSTALLATION

See DANGER and WARNING on page 16-1.

- If using a chain hoist, raise the vehicle and place transaxle in position on the jackstands. If using a floor jack, lower the jackstands to their lowest settings and place the transaxle in position on the jackstands.
- 2. Align the center hole in the saddle of the transaxle with the pilot bolt in the leaf spring assembly.
- 3. Install the two U-bolts, lockwashers, and nuts. Tighten the nuts to 25 ft-lb (34 N-m). Tighten the U-bolt nuts so an equal amount of thread is visible on each leg of the bolt.
- 4. Install the motor. See Section 15-Motor.
- 5. If using a chain hoist, lower the vehicle while guiding the leaf springs into the rear spring shackles. If using a floor jack, raise the differential while guiding the leaf springs into the rear spring shackles. Then raise the jackstands to support the transaxle.
- 6. Reconnect the four motor wires. Tighten the retaining nuts to 65 in-lb (7.3 N-m). Use two wrenches to prevent the motor posts from turning. **See following NOTE.**

NOTE

- IF THE MOTOR WIRES WERE NOT TAGGED WHEN DISCONNECTED, **SEE SECTION 11**, FIGURE 11-3, PAGE 11-4 FOR PROPER CONNECTION.
- Insert bolts through the spring shackles and bushings in the leaf spring eyes. Secure bolts with lock nuts. Tighten to 15 ft-lb (20.3 N-m).
- 8. Connect the brake cables.
- 9. Install the shock absorbers. Tighten shock absorber retaining nuts until the rubber bushings expand to the same size as the cup washers.
- 10. Install the rear wheels and finger tighten lug nuts.
- 11. Lift the vehicle and remove the jackstands. Lower vehicle and tighten lug nuts (using a crisscross pattern) to 55 ft-lb (74.6 N-m).
- 12. Test drive the vehicle to check for proper operation.

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Club Car

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2000 MAINTENANCE ERVICE SUPPLEMENT

POWERDRIVE PLUS VEHICLES

MANUAL NUMBER 102067506 EDITION CODE 0200A00000

FOREWORD

The Club Car PowerDrive Plus electric vehicle is engineered and built to provide the ultimate in performance efficiency. However, timely and appropriate vehicle maintenance and repair is essential for long-term vehicle performance and continued safe and reliable service.

This supplement provides detailed information for the maintenance and repair of PowerDrive Plus electric vehicles and should be used in conjunction with the 2000 DS Golf Car Maintenance and Service Manual, Publication Part No. 102067501. If you do not have the 2000 DS Golf Car Maintenance and Service Manual, you may order one from your local Club Car representative.

This supplement and the 2000 DS Golf Car Maintenance and Service Manual should be thoroughly reviewed prior to servicing the vehicle. The procedures provided herein must be properly implemented, and the DANGER, WARNING, and CAUTION statements must be heeded.

This supplement was written for the vehicle technician who already possesses knowledge and skills in electrical and mechanical repair. If the technician does not have such knowledge and skills, attempted service or repairs to the vehicle may render the vehicle unsafe. For this reason, Club Car advises all repairs and/or service be performed by an authorized Club Car distributor/dealer representative or by a Club Car factory trained technician.

This service supplement, along with the appropriate Maintenance and Service Manual, covers all aspects of typical service requirements for the PowerDrive Plus electric vehicle. If you need additional information, you may write to us at: Club Car, Inc.; P.O. Box 204658; Augusta, GA 30917 or contact a Club Car technical service representative at (706) 863-3000, ext. 3580.

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This manual effective July 26, 1999

A WARNING

- READ SECTION 1-SAFETY IN THE MAINTENANCE AND SERVICE MANUAL BEFORE ATTEMPTING ANY SERVICE ON THIS VEHICLE.
- BEFORE SERVICING VEHICLE, READ COMPLETE SECTION(S) AND ANY REFERENCED INFORMATION RELEVANT TO SERVICE OR REPAIR TO BE PERFORMED.

NOTE

- THIS MANUAL REPRESENTS THE MOST CURRENT INFORMATION AT THE TIME OF PUBLICATION. CLUB CAR, INC. IS CONTINUALLY WORKING TO FURTHER IMPROVE OUR VEHICLES AND OTHER PRODUCTS. THESE IMPROVEMENTS MAY AFFECT SERVICING PROCEDURES. ANY MODIFICATION AND/OR SIGNIFICANT CHANGE IN SPECIFICATIONS OR PROCEDURES WILL BE FORWARDED TO ALL CLUB CAR DISTRIBUTORS AND DEALERS AND WILL, WHEN APPLICABLE, APPEAR IN FUTURE EDITIONS OF THIS MANUAL.
- DAMAGE TO A VEHICLE OR COMPONENT THEREOF NOT RESULTING FROM A DEFECT OR WHICH OCCURS DUE TO UNREASONABLE OR UNINTENDED USE, OVERLOADING, ABUSE, OR NEGLECT (INCLUDING FAILURE TO PROVIDE REASONABLE OR NECESSARY MAINTENANCE AS INSTRUCTED IN THE VEHICLE OWNER'S MANUAL), ACCIDENT OR ALTERATION, INCLUDING INCREASING VEHICLE SPEED BEYOND FACTORY SPECIFICATIONS OR MODIFICATIONS WHICH AFFECT THE STABILITY OF THE VEHICLE OR THE OPERATION THEREOF, WILL VOID THE WARRANTY.
- CLUB CAR, INC. RESERVES THE RIGHT TO CHANGE SPECIFICATIONS AND DESIGNS AT ANY TIME WITHOUT NOTICE AND WITHOUT INCURRING ANY OBLIGATION OR LIABILITY WHATSOEVER.
- THERE ARE NO WARRANTIES EXPRESSED OR IMPLIED IN THIS MANUAL. SEE THE LIMITED WARRANTY FOUND IN THE VEHICLE OWNER'S MANUAL OR WRITE TO CLUB CAR, INC.

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SECTION 10-PERIODIC MAINTENANCE

A WARNING

- ONLY TRAINED TECHNICIANS SHOULD REPAIR OR SERVICE THIS VEHICLE. ANYONE DOING EVEN SIMPLE REPAIRS OR SERVICE SHOULD HAVE KNOWLEDGE AND EXPERIENCE IN ELECTRICAL AND MECHANICAL REPAIR.
- FOLLOW ALL PROCEDURES EXACTLY AS STATED IN THIS MANUAL, AND HEED ALL DANGER, WARNING AND CAUTION STATEMENTS, AS WELL AS THOSE AFFIXED TO THE VEHICLE.
- CHECK THE VEHICLE OWNER'S MANUAL FOR PROPER LOCATION OF ALL VEHICLE WARNING DECALS AND MAKE SURE THEY ARE IN PLACE AND ARE EASY TO READ.
- IF ANY PROBLEMS ARE FOUND DURING SCHEDULED INSPECTION OR SERVICE, DO NOT OPERATE THE VEHICLE UNTIL REPAIRS ARE MADE. FAILURE TO MAKE NECESSARY REPAIRS COULD RESULT IN FIRE, PROPERTY DAMAGE, SEVERE PERSONAL INJURY, OR DEATH.
- WEAR SAFETY GLASSES OR APPROVED EYE PROTECTION WHILE SERVICING VEHICLE. WEAR
 A FULL FACE SHIELD WHEN WORKING WITH BATTERIES.
- DO NOT WEAR LOOSE CLOTHING. REMOVE JEWELRY SUCH AS RINGS, WATCHES, CHAINS, ETC. BEFORE SERVICING VEHICLE.
- TURN KEY SWITCH **OFF**, PLACE FORWARD/REVERSE ROCKER SWITCH IN THE **NEUTRAL** POSITION, AND REMOVE KEY PRIOR TO SERVICING.
- MOVING PARTS! DO NOT ATTEMPT TO SERVICE THE VEHICLE WHILE IT IS RUNNING.
- HOT! DO NOT ATTEMPT TO SERVICE HOT MOTOR OR RESISTORS. FAILURE TO HEED THIS WARNING COULD RESULT IN SEVERE BURNS.
- USE INSULATED TOOLS WHEN WORKING NEAR BATTERIES OR ELECTRICAL CONNECTIONS. USE EXTREME CAUTION TO AVOID SHORTING OF COMPONENTS OR WIRING.
- TO AVOID UNINTENTIONALLY STARTING THE VEHICLE, PLACE THE TOW SWITCH IN THE **TOW** POSITION AND DISCONNECT BATTERIES AS SHOWN IN **FIGURE 10-1**, **PAGE 10-2**, THEN DISCHARGE THE CONTROLLER AS FOLLOWS:
 - PLACE THE FORWARD/REVERSE ROCKER SWITCH IN THE **REVERSE** POSITION AND LISTEN FOR THE REVERSE BUZZER. IF THE REVERSE BUZZER DOES NOT SOUND, THE CAPACITORS ARE DISCHARGED.
 - IF THE REVERSE BUZZER SOUNDS, TURN THE KEY SWITCH TO THE **ON** POSITION AND DEPRESS THE ACCELERATOR PEDAL UNTIL THE BUZZER CAN NO LONGER BE HEARD.
- IMPROPER MAINTENANCE OR USE OF THIS VEHICLE COULD RESULT IN DECREASED VEHICLE PERFORMANCE OR SEVERE PERSONAL INJURY.
- ANY MODIFICATION OR CHANGE TO THE VEHICLE WHICH AFFECTS THE STABILITY OR HANDLING OF THE VEHICLE, OR INCREASES MAXIMUM VEHICLE SPEED BEYOND FACTORY SPECIFICATIONS, COULD RESULT IN SEVERE PERSONAL INJURY OR DEATH.
- LIFT ONLY ONE END OF THE VEHICLE AT A TIME. BEFORE LIFTING, LOCK THE BRAKES AND CHOCK THE WHEELS THAT REMAIN ON THE FLOOR. USE A SUITABLE LIFTING DEVICE (CHAIN HOIST OR HYDRAULIC FLOOR JACK) WITH 1000 LB. (454 KG.) MINIMUM LIFTING CAPACITY. DO NOT USE LIFTING DEVICE TO HOLD VEHICLE IN RAISED POSITION. ALWAYS USE APPROVED JACKSTANDS OF PROPER WEIGHT CAPACITY TO SUPPORT VEHICLE.

PERIODIC MAINTENANCE General Information

GENERAL INFORMATION

To ensure continued reliable performance of the PowerDrive Plus vehicle, a Preventive Maintenance program should be established and followed. Preventive maintenance consists of the regular performance of scheduled vehicle service and maintenance procedures, and is the only way to ensure the vehicle provides the safe, reliable, and economical service it is designed to deliver. The following charts provide recommended service intervals for the lubrication and maintenance of the PowerDrive Plus vehicle. Note that critical areas such as brake operation, accelerator operation, steering and tires should be performed daily. These checks can easily be performed when moving the vehicle from the storage facility to the starting line. Any vehicle that is not functioning properly should be removed from service until it has been repaired.

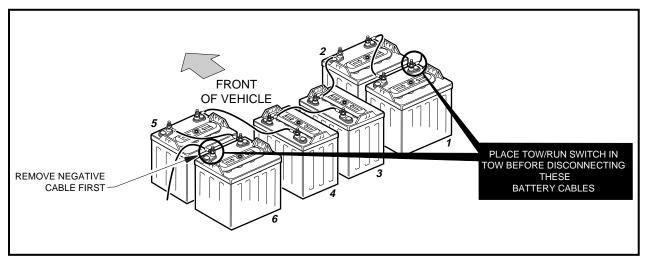


Figure 10-1 Battery Bank for PowerDrive Plus Vehicle

DAILY PRE-OPERATION SAFETY CHECKLIST

Inspect and drive the vehicle. Use the Pre-operation Checklist and Performance Inspection in Section 3–General Information located in the 1998/1999 DS Maintenance and Service Manual as a guide to check the following items.

- · Vehicle warning decals
- · Brake system
- · Park brake
- Reverse warning buzzer
- · Steering and linkages
- Proper acceleration and maximum speed
- Batteries
- Accelerator Switch

In addition, check the items listed below:

- Tires: Visually inspect for wear, damage and proper inflation.
- Forward/Reverse switch: Check for proper operation. See Controls, Section 3–General Information, in the 2000 DS Maintenance and Service Manual.
- Charger cord, plug and receptacle. See Charger Receptacle, Section 12–Electrical Components, Page 12-10.

PERIODIC SERVICE SCHEDULE

A WARNING

• SERVICE, REPAIRS, AND ADJUSTMENTS MUST BE MADE PER INSTRUCTIONS IN THE 2000 DS GOLF CAR MAINTENANCE & SERVICE MANUAL AND THIS SUPPLEMENT.

NOTE

- IF THE VEHICLE IS CONSTANTLY SUBJECTED TO HEAVY USE OR SEVERE OPERATING CONDITIONS, THE PREVENTIVE MAINTENANCE PROCEDURE SHOULD BE PERFORMED MORE OFTEN THAN RECOMMENDED IN THE SERVICE AND LUBRICATION SCHEDULES.
- BOTH THE PERIODIC SERVICE SCHEDULE AND PERIODIC LUBRICATION SCHEDULE MUST BE FOLLOWED TO KEEP VEHICLE IN OPTIMUM OPERATING CONDITION.

PERIODIC SERVICE SCHEDULE			
REGULAR INTERVAL	SERVICE		
Daily Service by Owner	Batteries	Charge batteries (after each use only).	
Weekly Service by Owner	Batteries	Check electrolyte level. Add water as necessary per Section 13–Batteries.	
Monthly Service by Owner or Trained Technician	Batteries	Wash battery tops and clean terminals with baking soda/water solution. Dispose of waste water properly .	
	Tires	Check air pressure and adjust as necessary. See Vehicle Capacities Chart on Page 10-4.	
	Multi-step Potentiometer	Check for cracks or other damage; make sure switch is securely fastened to frame. Check movable contact for correct operation.	
	General Vehicle	Wash battery compartment and underside of vehicle. Dispose of waste water properly.	
		Check brake shoes; replace if necessary. See Sectio 6, in the DS Maintenance and Service Manual.	
Semi-annual Service by	Brake System	Lubricate brake slides per Lubrication Schedule. See Section 6 in the DS Maintenance and Service Manual.	
Trained Technician Only		Check brake cables for damage; replace as required.	
(Every 50 hours of operation or 100 rounds of golf).	Electrical wiring and connections	Check for tightness and damage.	
or rounds or gon).	Forward and Reverse (F&R) Rocker Switch	Check condition of wire connections. Make sure connections are tight.	
	Front Wheel Alignment and Camber	Check and adjust as required. See Section 7 in the DS Maintenance & Service Manual.	
Annual Service by Trained Technician Only (Every 100 hours of operation or 200 rounds of golf).	Batteries	If batteries are not performing as expected, refer to Section 13–Batteries.	

A WARNING

• IF ANY PROBLEMS ARE FOUND, DO NOT OPERATE THE VEHICLE UNTIL REPAIRS ARE MADE. FAILURE TO MAKE NECESSARY REPAIRS COULD RESULT IN FIRE, PROPERTY DAMAGE, SEVERE PERSONAL INJURY, OR DEATH.

PERIODIC MAINTENANCE Lubrication

LUBRICATION

PERIODIC LUBRICATION SCHEDULE			
REGULAR INTERVAL SERVICE		PLACE*	RECOMMENDED LUBRICANT
	Brake pedal shaft bearings	1.	Dry Moly Lube - Club Car Part No. 1012151
	Brake Linkage and Pivots	2.	Dry Moly Lube - Club Car Part No. 1012151
Semi-Annually by Owner or Trained Technician (Every 50 hours of operation or every 100 rounds of golf).	Accelerator push rod pivots and mounts	3.	Dry Moly Lube - Club Car Part No. 1012151
	Charger receptacle	4.	WD 40
3 ,	Brake Slides	5.	Dry Moly Lube - Club Car Part No. 1012151
	Front Suspension (5 fittings)	6.	Chassis Lube - EP NLGI Grade 2
Periodic Lubrication Schedule continued on following page			
Annually by Trained Technician Only (Every 100 hours of operation or 200 rounds of golf)	Check/fill transaxle to plug level	7.	22 oz. (.67 liter) SAE 30 WT. API Class SE, SF, or SG Oil (or higher)
	Inspect front wheel bearings (Repack as necessary)	8.	Chassis Lube - EP NLGI Grade 2

^{*}See Figure 10-2 below.

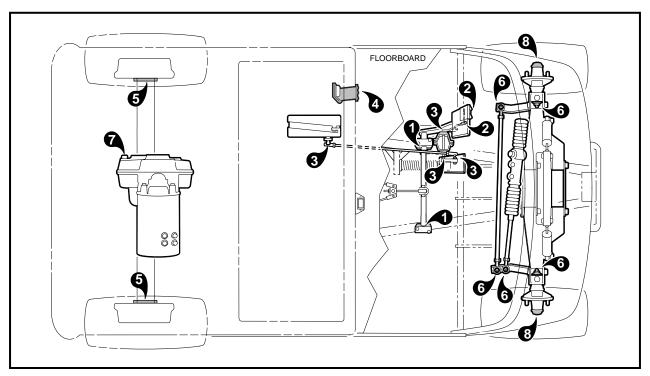


Figure 10-2 Vehicle Lubrication Points

VEHICLE CAPACITIES

CAPACITIES		
Transaxle	22 oz. (.67 liters)	
Tire Pressure	18-20 psi (124-138 kPa)	

Page 10-4 2000 PowerDrive Plus Vehicle Maintenance and Service Supplement

SECTION 11-ELECTRICAL SYSTEM AND TESTING

A DANGER

- BATTERY EXPLOSIVE GASES! DO NOT SMOKE. KEEP SPARKS AND FLAMES AWAY.
 VENTILATE WHEN CHARGING OR USING IN AN ENCLOSED SPACE. ALWAYS WEAR FULL FACE SHIELD AND RUBBER GLOVES WHEN WORKING ON OR NEAR BATTERIES.
- USE EXTREME CAUTION WHEN USING TOOLS, WIRES, OR METAL OBJECTS NEAR BATTERIES! A SHORT CIRCUIT AND (OR) SPARK COULD CAUSE AN EXPLOSION.
- BATTERY POISON! CONTAINS ACID! CAUSES SEVERE BURNS. AVOID CONTACT WITH SKIN, EYES, OR CLOTHING. ANTIDOTES:
 - EXTERNAL: FLUSH WITH WATER, CALL A PHYSICIAN IMMEDIATELY.
 - INTERNAL: DRINK LARGE QUANTITIES OF MILK OR WATER. FOLLOW WITH MILK OF MAGNESIA OR VEGETABLE OIL. CALL A PHYSICIAN IMMEDIATELY.
 - EYES: FLUSH WITH WATER FOR FIFTEEN MINUTES. CALL PHYSICIAN IMMEDIATELY.

A WARNING

- ONLY TRAINED TECHNICIANS SHOULD REPAIR OR SERVICE THIS VEHICLE. ANYONE DOING EVEN SIMPLE REPAIRS OR SERVICE SHOULD HAVE KNOWLEDGE AND EXPERIENCE IN ELECTRICAL AND MECHANICAL REPAIR.
- FOLLOW ALL PROCEDURES EXACTLY AS STATED IN THIS MANUAL, AND HEED ALL DANGER, WARNING AND CAUTION STATEMENTS, AS WELL AS THOSE AFFIXED TO THE VEHICLE.
- WEAR SAFETY GLASSES OR APPROVED EYE PROTECTION WHILE SERVICING VEHICLE. WEAR A FULL FACE SHIELD WHEN WORKING WITH BATTERIES.
- TURN KEY SWITCH **OFF**, PLACE FORWARD/REVERSE ROCKER SWITCH IN THE **NEUTRAL** POSITION, AND REMOVE KEY PRIOR TO SERVICING.
- DO NOT WEAR LOOSE CLOTHING. REMOVE JEWELRY SUCH AS RINGS, WATCHES, CHAINS, ETC. BEFORE SERVICING VEHICLE.
- USE INSULATED TOOLS WHEN WORKING NEAR BATTERIES OR ELECTRICAL CONNECTIONS. USE EXTREME CAUTION TO AVOID SHORTING OF COMPONENTS OR WIRING.
- TO AVOID UNINTENTIONALLY STARTING THE VEHICLE, PLACE TOW/RUN SWITCH IN TOW, THEN DISCONNECT BATTERIES AS SHOWN IN SECTION 10, FIGURE 10-1, PAGE 10-2 WHEN PERFORMING TESTS THAT DO NOT REQUIRE THE ELECTRICAL SYSTEM TO BE ENERGIZED. THE CAPACITORS WILL NORMALLY SELF-DISCHARGE AFTER THE BATTERY CABLES ARE DISCONNECTED. HOWEVER, TO ENSURE THE CAPACITORS ARE DISCHARGED AFTER THE BATTERY CABLES HAVE BEEN DISCONNECTED, PLACE THE FORWARD/REVERSE ROCKER SWITCH IN REVERSE AND LISTEN FOR THE REVERSE BUZZER.
 - IF THE REVERSE BUZZER DOES NOT SOUND, THE CAPACITORS ARE DISCHARGED.
 - IF THE REVERSE BUZZER SOUNDS, TURN THE KEY SWITCH TO THE **ON** POSITION AND DEPRESS THE ACCELERATOR PEDAL UNTIL THE BUZZER CAN NO LONGER BE HEARD.

GENERAL INFORMATION

The PowerDrive Plus vehicle uses a 48-volt electrical system that is powered by six eight-volt lead-acid batteries and includes an onboard computer. The electrical system in a PowerDrive Plus vehicle uses a shunt wound 3.2 hp motor and includes several additional features.

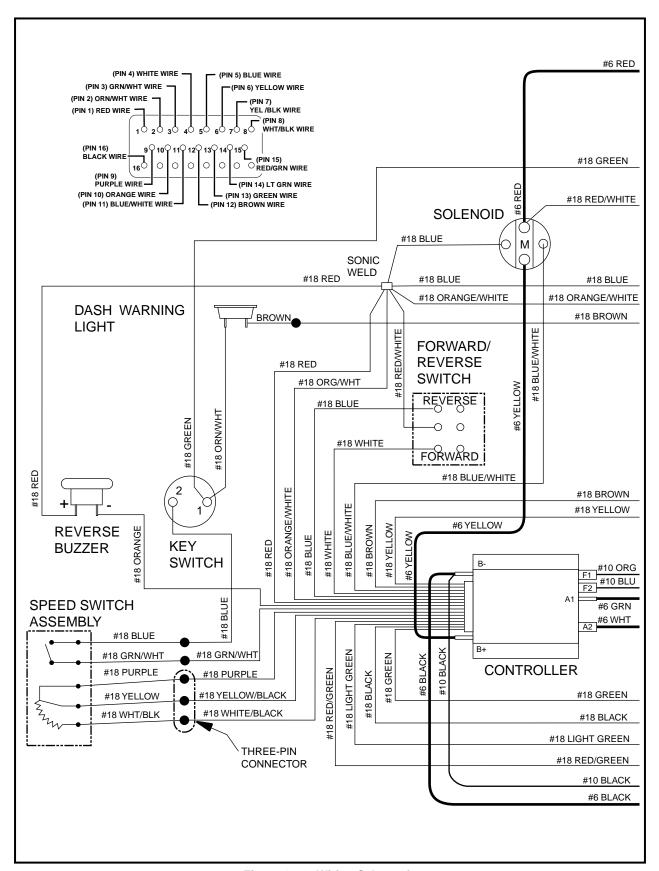


Figure 11-1 Wiring Schematic

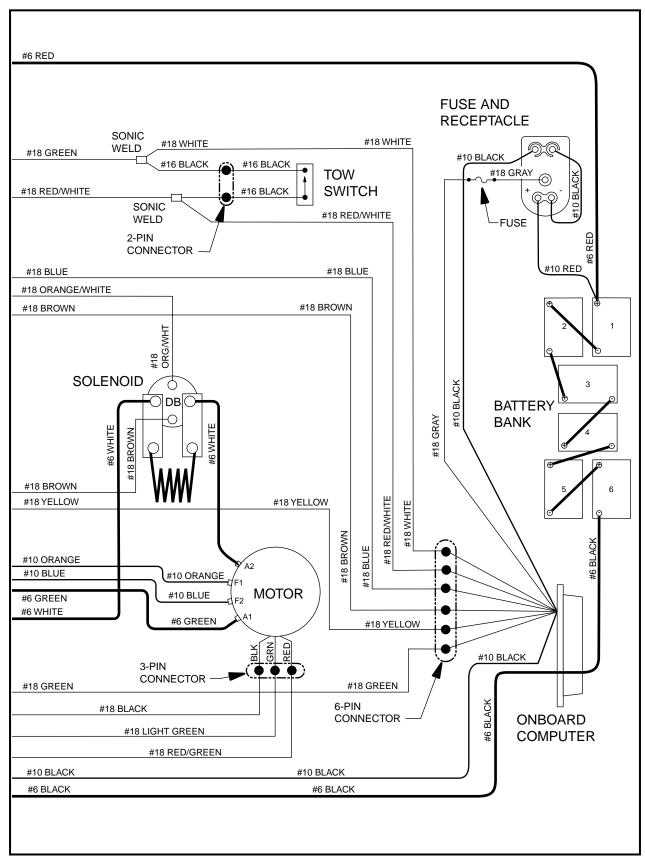


Figure 11-2 Wiring Schematic

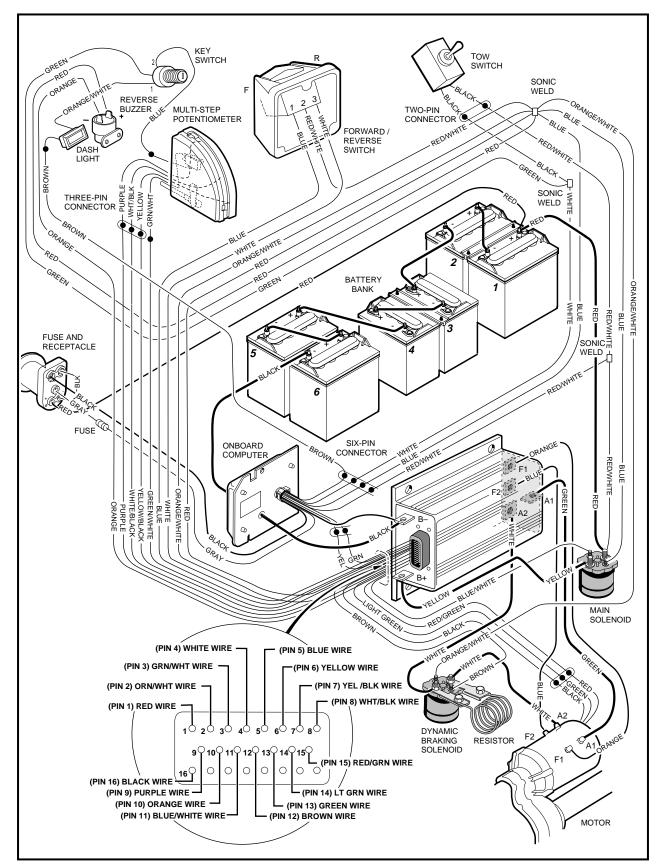


Figure 11-3 Wiring Diagram

General Information, Continued:

- Shunt Wound Motor: Unlike a series wound motor which increases or decreases the current flow (amperage) through the armature and field coils at the same rate, a shunt wound motor is able to vary the amount of amperage passing through the field coils separately from the current flow passing through the armature.
- Motor Braking: Under certain conditions a shunt wound motor also has the ability to act as an electrical brake to slow the vehicle. There are three features of the PowerDrive Plus electrical system which will activate the motor braking function: Zero Speed Detect, Pedal Down Motor Braking, and Pedal Up Motor Braking.
- Zero Speed Detect: This prevents the vehicle from rolling away uncontrolled should the driver park on a slope and leave the vehicle without locking the park brake. The vehicle will roll at about 1 mph. If the zero speed detect function remains engaged for two seconds or more, a warning buzzer will sound to alert the driver that motor braking has been activated.

WARNING

- ZERO SPEED DETECT MAY NOT HOLD THE VEHICLE ON VERY STEEP GRADES. DO NOT OPERATE VEHICLE ON SLOPES EXCEEDING 20% GRADES.
- Pedal Down Motor Braking: This feature helps to control vehicle downhill speed. When vehicle speed
 exceeds approximately 15 mph motor braking is activated, which holds top speed to approximately 13-15
 mph. Motor braking is automatically disengaged when vehicle speed slows below approximately 13 mph.
- **Pedal Up Motor Braking:** When vehicle speed is above 12 mph, releasing the accelerator pedal will activate motor braking, which slows the vehicle to approximately 9 mph. Once vehicle speed slows to below approximately 9 mph with the accelerator pedal still released, motor braking will be deactivated and the vehicle will coast freely.
- Motor/Generator: During motor braking, the motor acts as a generator which creates electrical current. The PowerDrive Plus electrical system has two current generating functions: Regenerative Braking and Dynamic Braking.
- Regenerative Braking: When motor braking is activated, the vehicle motor acts as a generator, slowing the vehicle as it creates energy that is used to charge the batteries.
- **Dynamic Braking:** If the batteries are at or near full charge and do not require an additional charge, the energy created as the motor slows the vehicle is disposed of through the energy displacement module.
- Tow/Run Switch: When the Tow/Run switch is in the RUN position, the vehicle will function normally. When the switch is in the TOW position, power to the OBC and controller is shut off, disabling the vehicle operating circuit and zero speed detect, allowing the vehicle to be towed.
- Motor Protection Circuit: If the vehicle is held in position on an incline by partially depressing the accelerator pedal instead of the brake, motor overheating could result. The motor protection circuit reduces the possibility of motor damage during this circumstance.
- **High Pedal Detect:** This function prevents unexpected vehicle movement if the key switch is turned ON after the accelerator is depressed. The vehicle will not move until the accelerator is depressed again.
- Onboard Computer (OBC): The OBC, 1) monitors battery condition, 2) monitors the rate of discharge while the vehicle is in use, 3) determines the amount of charge required based on the amount of use and shuts the charger off when this number is reached, 4) determines when to activate regenerative motor braking, 5) stores operating data which can be read by the Communication Display Module (CDM) and 6) locks out vehicle movement while the charger is plugged in.

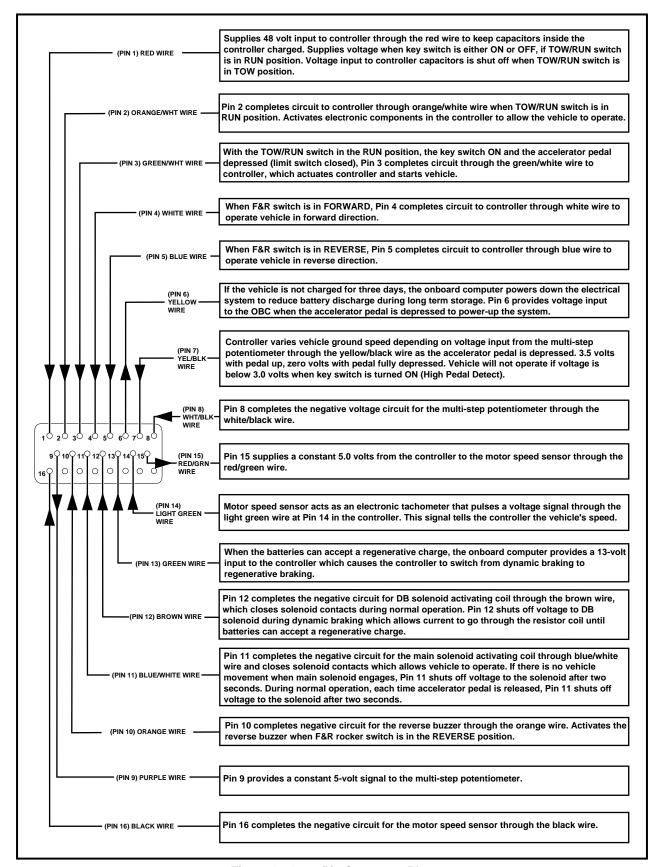


Figure 11-4 23-Pin Connector Plug

ELECTRICAL CIRCUITS

Read DANGER and WARNING on page 11-1.

The PowerDrive Plus vehicle has three distinct circuits: 1) the Control Circuit (Figure 11-7, Page 11-9), 2) the Power Circuit (Figure 11-8, Page 11-10), and 3) the Charge Circuit (Figure 11-9, Page 11-11).

THE CONTROL CIRCUIT

The Control Circuit consists of three individual circuits, 1) Onboard Computer Circuit (Figure 11-5, Page 11-7), 2) Solid State Speed Control Circuit (Figure 11-7, Page 11-9), and 3) Tow Switch Circuit (Figure 11-6, Page 11-8).

Onboard Computer Circuit

The onboard computer (OBC) circuit performs the following functions:

- 1. Provides power to the solenoids, Forward/Reverse switch, controller capacitors and reverse buzzer.
- 2. Powers down the electrical system during long term storage to reduce battery discharge.
- 3. Activates regenerative braking when the batteries can accept a regenerative charge.
- 4. Turns the charger ON and OFF during the charge cycle.
- 5. Locks out the motor speed controller to prevent the vehicle from moving during the charge cycle.
- 6. Illuminates the dash warning light if there is a problem with the batteries.
- 7. Sends a signal from the dash light to the optional Communication Display Module.

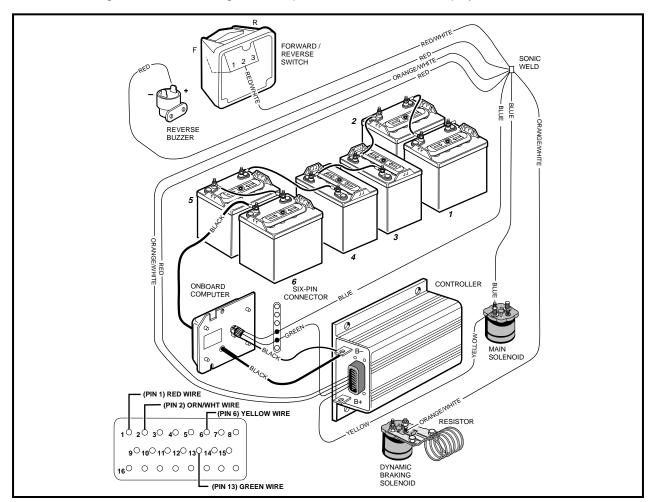


Figure 11-5 Onboard Computer Circuit

Battery Warning Light

The dash-mounted battery warning light performs two functions for the vehicle's electrical system:

Warning Light: The warning light alerts the operator to any problems with the batteries or charging system. The warning light will illuminate under the following conditions:

- Battery no-load voltage drops below 48 volts.
- 2. Batteries have discharged more than 75% of rated capacity.
- 3. AC power is interrupted during the charge cycle (DC plug is still connected).
- 4. Charge cycle times out at 16 hours.
- 5. When the DC cord is unplugged before the charge cycle is completed, the warning light will illuminate for 10 seconds if the charge is less than 90% complete.

LED Light: In addition to the warning light, there is an infrared LED in the dash light assembly which transmits an infrared signal from the OBC. This signal is received by the optional Communication Display Module which provides information on the condition of the vehicle and batteries. **See page 11-26.**

Solid State Speed Control Circuit

The Control Circuit performs the following functions:

- 1. Monitors vehicle ground speed through the motor speed sensor.
- 2. Regulates vehicle ground speed by using the multi-step potentiometer to determine accelerator pedal position.
- 3. Activates the reverse buzzer when the Forward/Reverse rocker switch is in REVERSE.

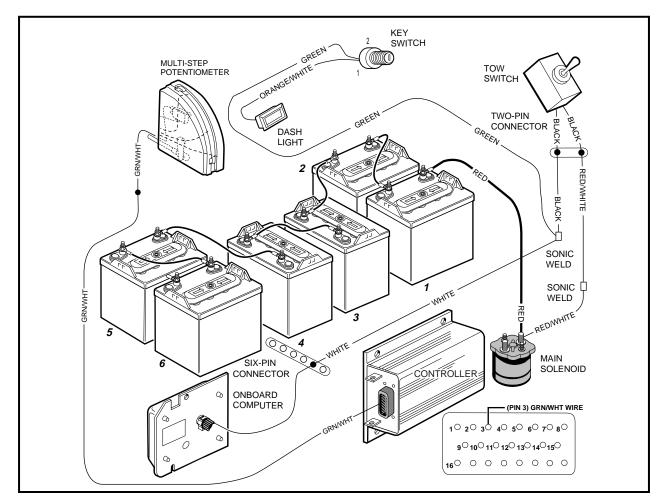


Figure 11-6 Tow Switch Circuit/Components

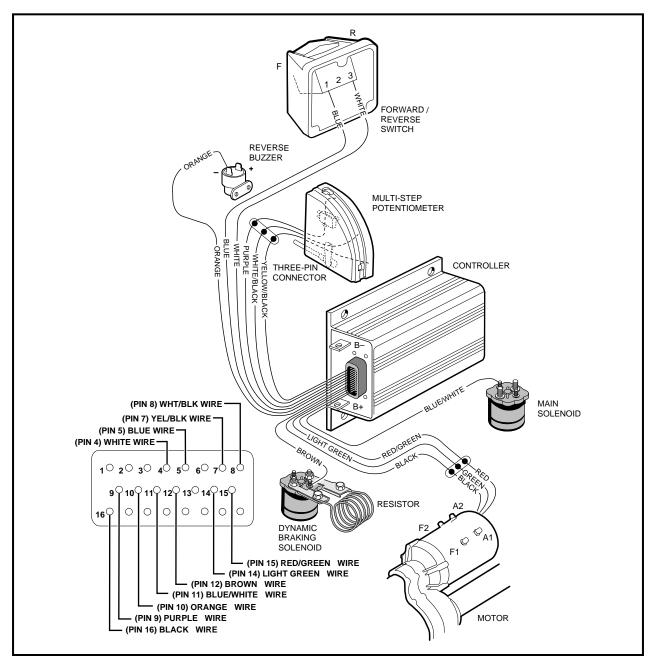


Figure 11-7 Solid State Speed Control Circuit

- 4. Regulates direction of vehicle movement through the Forward/Reverse switch.
- 5. Activates the solenoids.

Tow/Run Switch Circuit

The Tow/Run switch performs the following functions:

- 1. Provides power to the key switch and the dash warning light when in the RUN position.
- 2. Provides power to the No. 18 white OBC wire when in the RUN position.
- 3. Deactivates the vehicle's control circuit when in the TOW position.

THE POWER CIRCUIT

The function of the power circuit is to supply voltage from the battery pack to the motor. When regenerative motor braking is activated, the power circuit will direct motor-generated current to either the batteries or the energy displacement module, depending on the battery pack state of charge.

The Power Circuit consists of:

- Battery Pack (six eight-volt batteries)
- Solid State Speed Controller
- Electric Motor
- Solenoid Contacts
- Energy Displacement Module (Resistor Coil)
- All 6 Gauge Power Wires

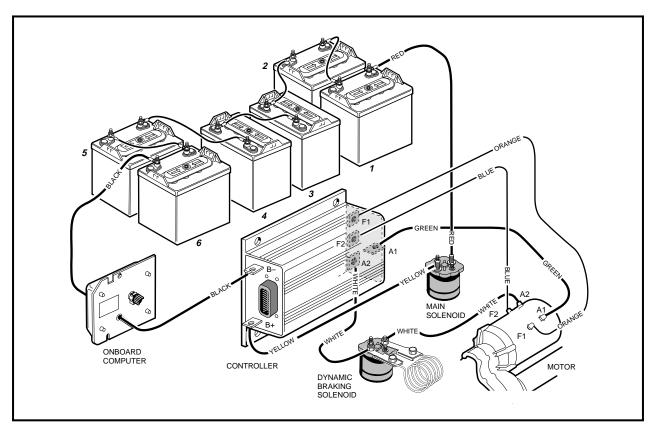


Figure 11-8 Power Circuit

Electric Motor

The electric motor is discussed in **Section 15–Motor**.

THE CHARGE CIRCUIT

The charge circuit consists of the onboard computer, battery charger, DC charger plug, charger receptacle, receptacle fuse link and the battery pack. The charge circuit supplies current from the battery charger to the batteries when the DC cord is plugged into the vehicle's charger receptacle. The batteries will be discussed in **Section 13–Batteries**.

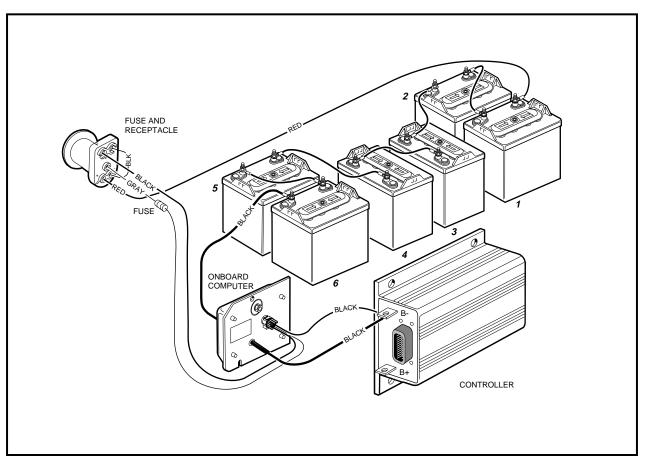


Figure 11-9 Charge Circuit

DIAGNOSTIC FLOW CHARTS

The diagnostic flow charts included in this section may be used as a reference when performing test procedures on the PowerDrive Plus vehicle. More detailed system testing instructions follow.

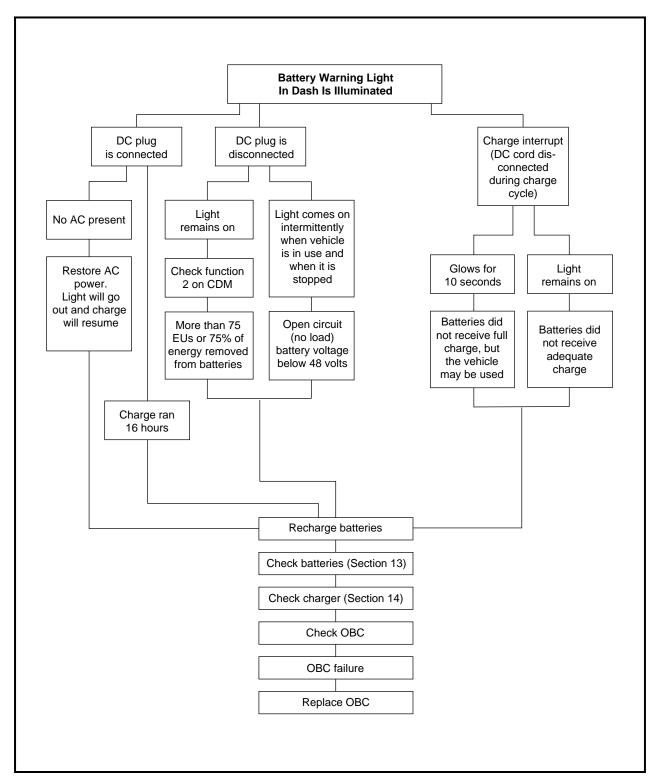


Figure 11-10 Battery Warning Light Diagnostic Chart

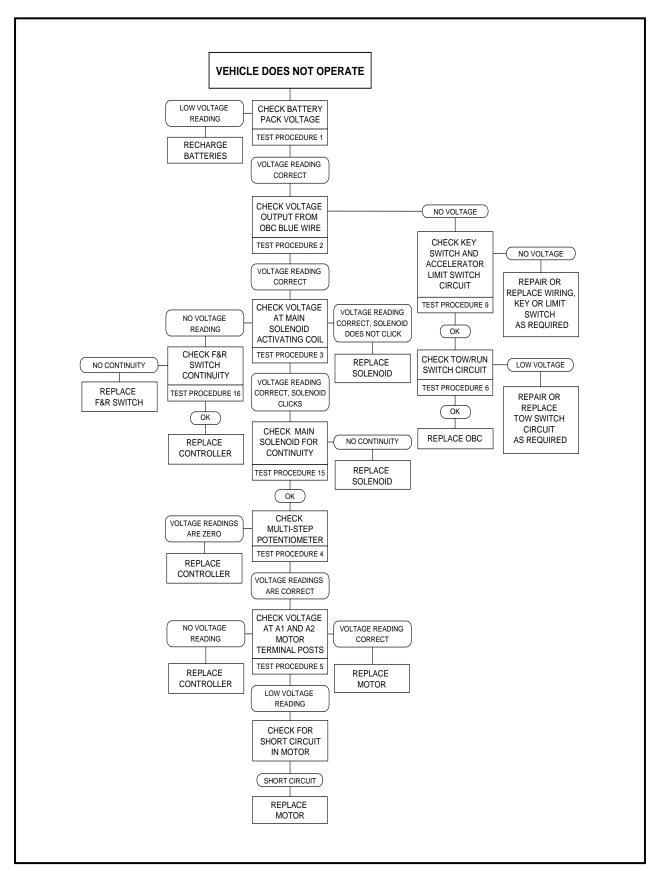


Figure 11-11 Vehicle Does Not Operate

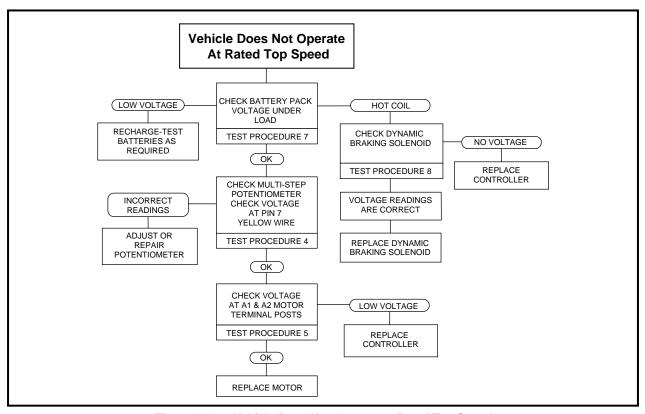


Figure 11-12 Vehicle Does Not Operate at Rated Top Speed

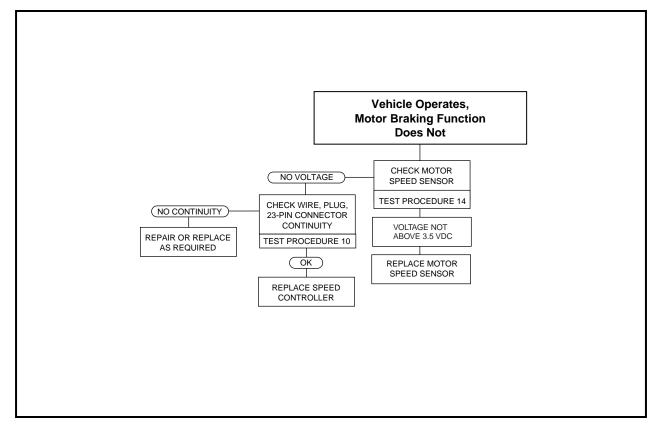


Figure 11-13 Vehicle Operates, No Motor Braking

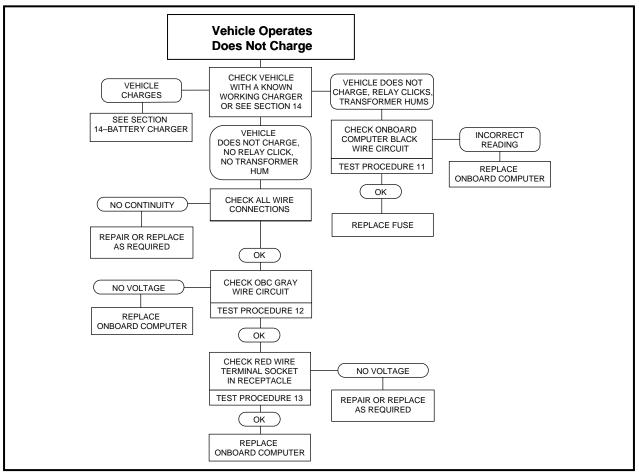


Figure 11-14 Vehicle Operates, Does Not Charge

TEST PROCEDURES

Using the following procedures, the entire PowerDrive Plus electrical system can be tested without major disassembly of the vehicle.

A CAUTION

• IF WIRES ARE REMOVED OR REPLACED MAKE SURE WIRING AND/OR WIRING HARNESS IS PROPERLY ROUTED AND SECURED TO VEHICLE FRAME. FAILURE TO PROPERLY ROUTE AND SECURE WIRING COULD RESULT IN VEHICLE MALFUNCTION, PROPERTY DAMAGE OR PERSONAL INJURY.

INDEX OF TEST PROCEDURES

- 1. Batteries / Voltage Check
- 2. Voltage Output From Onboard Computer
- 3. Voltage At Main Solenoid Activating Coil
- 4. Multi-Step Potentiometer (Wiper Switch) Voltage
- 5. A1 and A2 Motor Voltage
- 6. Tow/Run Switch

- 7. Battery Pack Voltage (Under Load)
- 8. Dynamic Braking Solenoid Activating Coil
- 9. Key Switch and Limit Switch Circuit
- 10. 23-Pin Connector
- 11. Onboard Computer Silicon Controlled Rectifier (SCR) Circuit
- 12. OBC Gray Wire and Fuse
- 13. Voltage At Charger Receptacle Red Wire Socket
- 14. Motor Speed Sensor
- 15. Main Solenoid Continuity
- 16. Forward/Reverse Rocker Switch
- 17. Reverse Buzzer
- 18. Rebooting The Onboard Computer
- 19. Battery Warning Light

Test Procedure 1-Batteries / Voltage Check

Read DANGER and WARNING on page 11-1.

With batteries connected and using a multimeter set to 200 volts DC, place red (+) probe on the positive post of battery No. 1 and the black (-) probe on the negative post of battery No. 6. The multimeter should indicate at least 48 volts with the batteries fully charged. If not, check for loose battery connections or a battery installed in reverse polarity. Refer to Section 13-Batteries, for further details on battery testing (Figure 11-15, Page 11-16).

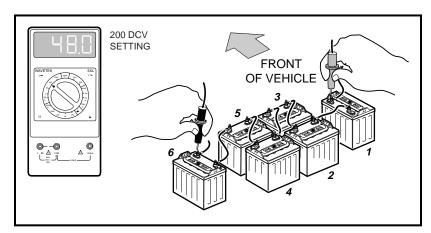


Figure 11-15 Battery Test

Test Procedure 2–Voltage Output From Onboard Computer Read DANGER and WARNING on page 11-1.

- 1. With batteries connected and using a multimeter set to 200 volts DC, place black lead on battery No. 6 negative post and red lead (with insulation probe) on blue onboard computer wire (at a point between the OBC and the six-pin connector). The reading should be approximately 48-50 volts (full battery voltage). If the reading is not 48-50 volts, proceed to step 2. If the reading is 48-50 volts, proceed to Test 3.
- 2. Place insulation probe on blue 18 gauge wire at a point between OBC six-pin connector and main wire harness. If reading is 48-50 volts, check blue wire terminal connectors inside six-pin connector at OBC six-pin connector. Make sure pins are properly aligned inside housing. Make sure wire colors match.

- 3. If reading is zero volts, plug the charger DC cord into the vehicle charger receptacle. If the dash light illuminates for 10 seconds, the OBC is now activated. Unplug the DC cord; the reading at the OBC blue wire should be approximately 48-50 volts. When the DC cord is disconnected, the solenoids should click on for two seconds and then click off. If the vehicle now operates normally, the DC cord has powered up the electrical system. The electrical system should also power-up when the accelerator pedal is depressed. To check the accelerator pedal function, see Test Procedure 4.
- 4. If the dash light illuminates and the solenoids do not click:
 - 4.1. Using a multimeter set to 200 volts DC, place black lead on battery number 6 and place red lead (with insulation probe) on blue 18 gauge wire at OBC six-pin connector.
 - 4.2. With Tow/Run switch in the RUN position, the voltage reading should be approximately 48 volts.
 - 4.3. If the reading is zero volts, replace the OBC.
- 5. If the dash light does not illuminate and the solenoids do not click, check the OBC activation circuit.
 - 5.1. Using a multimeter set to 200 volts DC, place the black lead on battery No. 6 negative post and place the red lead (with insulation probe) on the red 18 gauge wire located on the OBC side of the six-pin connector. The reading should be approximately 48 volts.
 - 5.2. Place wire probe on the 18 gauge red/white wire (harness side of six-pin connector). Multimeter should indicate 48 volts. If voltage is correct, check connections in the six-pin connector. If connections are correct, OBC activation circuit has failed. Replace OBC.

Test Procedure 3–Voltage At Main Solenoid Activating Coil Read DANGER and WARNING on page 11-1.

- 1. With the batteries connected, place Tow/Run switch in TOW and wait 10 seconds before proceeding. Using a multimeter set to 200 volts DC, place black lead on small post with blue/white wire and place red lead on small post with blue wire.
- 2. Place Tow/Run switch in RUN. Solenoid should activate for 2-3 seconds and then deactivate. When solenoid clicks, voltage reading should be approximately 48-50 volts (full battery voltage). If the voltage reading is 48-50 volts and the solenoid does not click, replace the solenoid.
- 3. If the voltage reading is zero volts, replace speed controller.

Test Procedure 4–Multi-Step Potentiometer (Wiper Switch) Voltage Read DANGER and WARNING on page 11-1.

- 1. With the batteries connected, place Tow/Run switch in RUN. Using a multimeter set to 20 volts DC, place black lead on battery No. 6 negative post and place red lead (with insulation probe) on purple wire at a point between the three-pin connector and wiper switch. The reading should be approximately 3.75 volts.
- 2. If reading is zero volts, check the purple wire continuity from the connector to the controller, the purple wire continuity from the connector to the wiper switch, and the three-pin connector at the wiper switch. If all of the continuity readings are correct, replace the controller.
- 3. With multimeter set to 200 volts DC, place the red lead on battery No. 1 positive post and the black lead (with insulation probe) on the white/black wire at a position between the three-pin connector and the wiper switch. The reading should be approximately 48-50 volts.
- 4. If reading is zero volts, check white/black wire continuity from three-pin connector to 23-pin connector. Check white/black wire continuity from three-pin connector to wiper switch. Check terminal positions in three-pin connector at the wiper switch. If all of the continuity readings are correct, replace the speed controller.
- 5. With multimeter set to 20 volts DC, place the black lead on battery No. 6 negative post and the red lead (with insulation probe) on the No. 18 yellow wire at a point between the three-pin connector and the wiper switch. The reading should be approximately 3.75 volts with the pedal up. Slowly depress the accelerator pedal and note the readings on the multimeter. As the pedal is depressed, the reading will decrease in increments until it reaches zero volts when the pedal is fully depressed.

Test Procedure 4-Multi-step Potentiometer (Wiper Switch) Voltage, Continued:

- 6. If reading does not decrease as pedal is depressed, check movable contact and resistors in wiper switch.
- 7. If the reading is not zero volts with the pedal fully depressed, the vehicle will not operate at rated top speed. Check the resistors and adjustment of the wiper switch assembly.
 - 7.1. Disconnect the battery cables (negative cable first) and then disconnect the three-pin connector at multi-step potentiometer. Remove switch cover by pressing down on the locking tabs.
 - 7.2. With multimeter set for 20K Ω (ohms), connect black (–) lead of multimeter to purple wire terminal end (located in three-pin connector on potentiometer). Connect red (+) probe to yellow wire terminal end.
 - 7.3. With the accelerator pedal fully up (not depressed), the reading should be approximately 0 Ω (ohms).
 - 7.4. Measure resistance while depressing the accelerator pedal. The measured resistance should increase incrementally in six steps:

1st Step: 910 Ω (ohms) (approx.) 2nd Step: 1660 Ω (ohms) (approx.) 3rd Step: 2570 Ω (ohms) (approx.) 4th Step: 3570 Ω (ohms) (approx.) 5th Step: 4570 Ω (ohms) (approx.) 6th Step: 5570 Ω (ohms) (approx.)

NOTE

- IF AN INCREASE IN RESISTANCE FROM 0 TO (APPROXIMATELY) 5000 Ω (OHMS) IS OBTAINED WHEN THE ACCELERATOR PEDAL IS DEPRESSED WITHOUT EXCEEDING (APPROXIMATELY) 7000 Ω (OHMS), THEN THE SPEED SWITCH RESISTOR ASSEMBLY IS IN GOOD CONDITION.
 - 7.5. If the resistance steps were not correct and the accelerator pedal is properly adjusted, then replace the failed resistor(s). **See Section 12–Components**.
 - 7.6. Reconnect three-pin connector assembly.
- 8. If reading is zero volts, check continuity of yellow wire and three-pin connector terminal at wiper switch.

Test Procedure 5-A1 and A2 Motor Voltage

Read DANGER and WARNING on page 11-1.

- 1. With the batteries connected and using a multimeter set to 200 volts DC, place the black lead on the A2 motor terminal (white wire) and connect the red lead to the A1 (green wire) motor terminal.
- 2. With Tow/Run switch in RUN, place Forward/Reverse switch in FORWARD, turn key switch ON and slowly depress accelerator pedal.
- 3. As the accelerator pedal is depressed, the voltage reading should increase from approximately 5 volts when the accelerator limit switch closes, to approximately 48 volts with the accelerator pedal fully depressed.
 - 3.1. If there is no voltage reading, check the wiper switch (see Test Procedure 4) and the continuity of the large post of the main solenoid (see Test Procedure 15).
 - 3.2. Disconnect battery wires. Check continuity on A1 and A2 motor terminal posts and continuity of the F1 and F2 motor terminal posts. Also, check continuity of all motor wires. **See Section 15–Motor.**

Test Procedure 6-Tow/Run Switch

Read DANGER and WARNING on page 11-1.

- With the batteries connected and using a multimeter set on 200 volts DC, connect black lead to negative post of battery No. 6 and connect red lead (with insulation probe) on black wire on two-pin connector on Tow/Run switch. (Connect the insulation probe to the black wire on the wire harness side of the two-pin connector).
- 2. With the Tow/Run switch in the RUN position, the reading should be approximately 48-50 volts. With the switch in the TOW position, the reading should be zero volts.
- 3. If the reading is not zero volts with the switch in the TOW position, replace the switch.
- 4. If the reading is zero volts with switch in the RUN position, check continuity of the two-pin connector and the red/white 18 gauge wire from the large post of the solenoid to the two-pin connector at the Tow/Run switch.
- 5. If the continuity readings are correct, replace the Tow/Run switch.

Test Procedure 7–Battery Pack Voltage (Under Load) Read DANGER and WARNING on page 11-1.

- Before proceeding with this test procedure, the batteries must be connected and fully charged. Using a
 36 to 48-volt battery discharge machine (Club Car No. 101831901), connect the positive (+) lead of the
 discharge machine to battery No. 1 positive post and connect the negative (-) lead to battery No. 6
 negative post. Record reading from discharge machine.
- 2. Record the voltage reading of battery pack while under load, as displayed on the discharge machine (discharge machine is ON).
- 3. A fully charged set of batteries in good condition should read between 46-49 volts while under load.
- 4. A reading of 32-46 volts indicates discharged or failed batteries. Each battery should be checked with a multimeter while under load.
- 5. A reading of 32 volts or less will not activate discharge machine. Batteries are deeply discharged or have failed.
- 6. Recording the battery pack voltage reading while under load provides a more accurate diagnosis of the condition of the batteries. When the discharge machine is ON, it places the battery pack under load and many times can help determine if one or more batteries in the set have failed. Testing battery voltage while the batteries are not under load will not always indicate the true condition of the batteries.
- 7. If batteries test okay and vehicle runs slowly, test the dynamic braking solenoid for proper operation.
- 8. Drive vehicle approximately 100 ft. with the accelerator pedal half way depressed to the floor. Stop the vehicle and check the resistor coil on the dynamic braking solenoid by placing hand close to (but not touching) the coil. If the coil is hot, replace the solenoid.

WARNING

• DO NOT TOUCH THE ENERGY DISPLACEMENT MODULE (RESISTOR COIL); IT MAY BE EXTREMELY HOT. A HOT ENERGY DISPLACEMENT MODULE COULD CAUSE SEVERE BURNS.

Test Procedure 8-Dynamic Braking Solenoid Activating Coil Read DANGER and WARNING on page 11-1.

1. With batteries connected and with key switch ON and Forward/Reverse switch in FORWARD, place Tow/Run switch in RUN. Using a multimeter set to 200 volts DC, place the red lead on battery No. 1 positive post and the black lead on the brown wire at the dynamic braking solenoid small post. With the accelerator pedal up, the reading should be less than 1 volt. With the accelerator pedal depressed, the reading should be 48-50 volts (full battery voltage).

Test Procedure 8-Dynamic Braking Solenoid Activating Coil, Continued:

- 2. If the reading is not approximately 48 volts when the accelerator pedal is depressed, check the continuity of the brown wire and check pin 12 in the 23-pin connector (see Test Procedure 10). If the connector and continuity readings are correct, replace the controller. If the reading is approximately 48 volts, proceed to step 3.
- 3. Using a multimeter set to 200 volts DC, place black lead on battery No. 6 negative post and place red lead on the orange/white wire at dynamic braking solenoid small post. The reading should be 48 to 50 volts (full battery voltage) with the accelerator pedal either up or fully depressed, key switch OFF and the Forward/Reverse rocker switch in NEUTRAL and Tow/Run switch in RUN. If reading is zero volts, check continuity of the orange/white wire to the blue OBC wire in the six-pin connector located at the OBC. If the continuity of the orange/white wire to the blue OBC wire in the six-pin connector is present, replace the dynamic braking solenoid.

Test Procedure 9–Key Switch and Limit Switch Circuit Read DANGER and WARNING on page 11-1.

- With batteries connected and using a multimeter set to 200 volts DC, place the black lead on battery No. 6 negative post and place the red lead on the green/white wire where it connects to the multi-step potentiometer (multi-step potentiometer side).
- 2. With Tow/Run switch in RUN, key switch ON, and Forward/Reverse rocker switch in FORWARD, the voltage reading should be zero volts. When the accelerator pedal is depressed, the voltage reading should be approximately 48 volts (full battery voltage). If the voltage reading is zero with the accelerator pedal depressed, check the key switch and limit switch circuit using the following test procedures.
 - 2.1. Reconnect the green/white wire to the multi-step potentiometer.
 - 2.2. Using a multimeter set to 200 volts DC, place black lead on battery No. 6 negative post and the place red lead on blue wire where it connects to the multi-step potentiometer. With the key switch ON, the reading should be approximately 48 volts (full battery voltage).
 - 2.3. If the reading is zero volts, check the key switch continuity and the continuity of the blue wire that goes from the key switch to the multi-step potentiometer.
 - 2.4. If the reading is approximately 48 volts, proceed to step 3.
- 3. Using a multimeter set to 200 volts DC, place the black lead on battery No. 6 negative post and place the red lead on the blue wire where it connects to the multi-step potentiometer (harness side). With the key switch ON and the Tow/Run switch in the RUN position, the reading should be approximately 48 volts (full battery voltage).
 - 3.1. If the reading is zero volts, check the blue wire on each side of the connector (at the wiper switch) and make sure the terminals are securely crimped to the wire.
 - 3.2. If the reading is approximately 48 volts, proceed to step 4.
- 4. Using a multimeter set to 200 volts DC, place the black lead on battery No. 6 negative post and place the red lead on the green/white wire where it connects to the multi-step potentiometer (multi-step potentiometer side). With the Tow/Run switch in the RUN position, the key switch ON, the Forward/ Reverse rocker switch in NEUTRAL and the accelerator pedal depressed, the reading should be approximately 48 volts (full battery voltage).
 - 4.1. If the reading is zero volts, test the continuity of the accelerator limit switch and the green/white wire. If the limit switch does not pass the continuity test, replace the switch. See "Accelerator Pedal Limit Switch" in Section 12 on page 12-5.
 - 4.2. If the reading is approximately 48 volts, proceed to step 5.
- 5. Place black lead of multimeter (set to 200 volts DC) on negative post of battery No. 6 and red lead on the green/white wire where it connects to the multi-step potentiometer (multi-step potentiometer side). With the key switch ON and the accelerator pedal depressed, the reading should be approximately 48 volts.

- 5.1. If reading is zero volts, make sure the terminals on each of the green/white wires are securely crimped.
- 5.2. If the reading is approximately 48 volts, check the green/white wire at the pin 3 position in the 23-pin connector to make sure the terminal socket is properly seated in the plug and the wire is securely crimped to the terminal. **See Test Procedure 10**.

Test Procedure 10–23-Pin Connector Read DANGER and WARNING on page 11-1.

- 1. With Tow/Run switch in the TOW position, disconnect the battery cables (negative cable first) and discharge the controller. **See Section 10, Figure 10-1, Page 10-2.**
- 2. Disconnect 23-pin connector from controller. Insert small screwdriver under plug clip and turn to release the clip from the 23-pin connector (Figure 11-16, Page 11-21). Inspect terminal ends inside plug to ensure they are in position and seated in plug housing. If any terminals look like they are not pushed all the way into the connector, then disconnect the red cap inside the plug housing before the terminal sockets are repositioned. After the terminal has been pushed into the housing, gently pull on the wire to ensure it is locked into place. Once the terminal socket is in position, press the red cap down until it snaps into place.
- 3. Check wires in the plug to make sure none are broken at the terminal pin crimp. Repair or replace as required.
- 4. Check the wire colors of each wire and make sure that the colors for each pin position match the wire colors in the wiring diagram (Figure 11-3, Page 11-4).
- 5. When connecting the 23-pin connector to the controller, push plug into controller receptacle with enough force to lock plug into place. An audible click will be heard when plug is properly seated to the controller.
- 6. Reconnect the battery cables (positive cable first) and tighten to 110 in-lb (12.4 N-m). Coat with Battery Protector Spray (Club Car Part No. 1014305) to minimize corrosion.

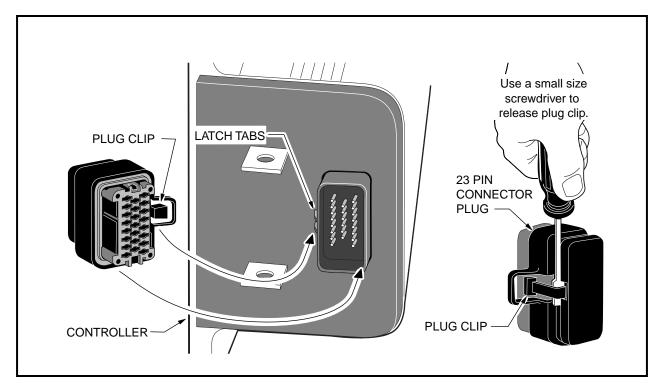


Figure 11-16 23-Pin Connector

Test Procedure 11–Onboard Computer Silicon Controlled Rectifier (SCR) Circuit Read DANGER and WARNING on page 11-1.

A silicon controlled rectifier (SCR) acts as a switch between the two black wires in the OBC to complete the negative side of the circuit to allow the charger to charge the batteries.

A black 10 gauge wire is connected to the battery negative (B-) terminal on the controller and goes to the onboard computer. Another black 10 gauge wire is attached to the onboard computer and goes to the charger receptacle.

Use the following procedure to test the SCR:

- With batteries connected and using a multimeter set to 200 volts DC, place the red lead on the positive post of battery No. 1 and place the black lead on the receptacle fuse terminal that has the black 10 gauge OBC wire attached to it. The reading should be approximately 36-42 volts.
- 2. If the reading is zero volts, check the black 10 gauge wire connections at the controller and receptacle. Check the continuity of the black 10 gauge wires. If the wires and connections are okay, the SCR has failed. Replace the OBC. If the reading is correct, proceed to step 4.
- 3. Plug in AC and DC cords. When charger relay clicks ON, reading should be approximately 48 volts (full battery voltage). If the reading does not rise from approximately 40 volts to full battery voltage when the DC cord is plugged in and the relay clicks ON, check the receptacle fuse and black wire terminal socket in the receptacle.

Test Procedure 12–OBC Gray Wire and Fuse Read DANGER and WARNING on page 11-1.

- With batteries connected and using a multimeter set to 200 volts DC, connect red lead to positive post
 of battery No. 1 and black lead (with insulation probe) to gray 16 gauge wire at a point between fuse
 and receptacle. Reading should be approximately 48 volts. If reading is zero volts, check gray wire fuse
 and fuse holder.
- 2. If the reading in step 1 is 48 volts, plug the DC cord into the vehicle's charger receptacle. The voltage reading should drop to approximately 4.0 volts before the charger relay clicks on.
- 3. When the charger relay is activated, the reading should rise to approximately 48 volts.
- 4. If voltage does not drop to approximately 4.0 volts when the DC cord is plugged in and then rise to approximately 48 volts when the charger relay clicks ON, the gray wire circuit in the OBC has failed. Replace the OBC.

Test Procedure 13-Voltage At Charger Receptacle Red Wire Socket Read DANGER and WARNING on page 11-1.

- With batteries connected and using a multimeter set to 200 volts DC, place the black lead on the negative post of battery No. 6 and place the red lead on the charger receptacle socket connected to the red 10 gauge wire. The reading should be 48-50 volts (full battery voltage).
- 2. If the reading is zero volts, check the continuity of the 10 gauge red wire from the positive post of battery No. 1 to the receptacle socket.

Test Procedure 14–Motor Speed Sensor

Read DANGER and WARNING on page 11-1.

- 1. With batteries connected, disconnect the three-pin connector at the motor speed sensor.
- 2. Check voltage at black wire:
 - 2.1. Using a multimeter set to 200 volts DC, place the red lead on battery No. 1 positive post and place the black lead on the black wire terminal socket in the three-pin connector. The voltage reading should be 48 to 50 volts (full battery voltage).

- 2.2. If the reading is zero volts, check the continuity of the black wire from the 23-pin connector to the three-pin connector. If the continuity is correct, replace the controller.
- 3. Check voltage at red/green wire:
 - 3.1. With Tow/Run switch in RUN and using a multimeter (set on 20 volts DC), place black lead on battery No. 6 negative post and place red lead on red/green wire terminal socket in three-pin connector. Voltage reading should be from 5.01 to 5.08 volts.
 - 3.2. If the voltage reading is zero volts, check the continuity of the red/green wire from the 23-pin connector to the three-pin connector. If the wire continuity is correct, replace the controller.
 - 3.3. If the reading is below 3.50 volts, replace the controller.
 - 3.4. If the voltage reading is correct, proceed to step No. 4.
- 4. Check voltage at light green wire:
 - 4.1. Using a multimeter set on 20 volts DC, place the black lead on battery No. 6 negative post and place the red lead on the light green wire female terminal in the three-pin connector. The voltage reading should be from 4.60 to 4.90 volts.
 - 4.2. If the voltage is zero volts, check the continuity of the light green wire from the 23-pin connector to the three-pin connector. If the continuity is correct, replace the controller.
 - 4.3. If reading is below 3.50 volts, check wire/plug continuity and replace the controller if necessary.
- Reconnect the three-pin connector at the motor speed sensor. Using a multimeter set to 20 volts DC, place the black lead on battery No. 6 negative post and place the red lead (with insulation probe) on the green wire between the three-pin connector and the motor speed sensor.
 - 5.1. Raise one rear wheel off ground. Slowly turn the rear wheel to rotate the motor armature. As the armature rotates, the voltage reading should alternate from zero to approximately 4.85 volts. The voltage reading will fluctuate from zero to 4.85 volts and back to zero four times for each revolution of the motor armature.

NOTE

- THE VOLTAGE READING OF 4.85 IS AN APPROXIMATE READING. THE ACTUAL READING MAY VARY FROM 4.50 TO 4.90 VOLTS.
 - 5.2. If there is no voltage reading, or the voltage reading is not above 3.50, replace the motor speed sensor.
- 6. If vehicle does not operate and the main solenoid does not click, but the dynamic braking solenoid does click when the key switch is turned ON or OFF, the motor speed sensor may be shorted. To test for this condition, disconnect the motor speed sensor and attempt to drive the vehicle. If the vehicle operates normally, replace the motor speed sensor. If the dynamic braking solenoid continues to click each time the key switch is turned ON or OFF with the motor speed sensor disconnected, replace the controller.

Test Procedure 15-Main Solenoid Continuity Read DANGER and WARNING on page 11-1.

- 1. With Tow switch in the TOW position, disconnect the battery wires (negative cable first) and discharge the controller. **See Section 10, Figure 10-1, Page 10-2.**
- 2. Disconnect yellow 6 gauge wire from main solenoid. Raise rear wheel off ground. Using a multimeter set to 200k Ω (ohms), place the black lead on the main solenoid large post where the yellow 6 gauge wire was removed and place the red lead on the large post with the red 6 gauge wire. The reading should be no continuity.
- 3. Reconnect yellow 6 gauge wire to main solenoid. Reconnect battery cables (positive cable first) and tighten to 110 in-lb (12.4 N-m).

Test Procedure 15–Main Solenoid Continuity, Continued:

4. With Tow/Run switch in RUN, turn the key switch to ON, place the Forward/Reverse rocker switch in FORWARD and depress the accelerator pedal. The solenoid should click and the meter should show continuity. If the reading is no continuity, replace the solenoid.

Test Procedure 16–Forward/Reverse Rocker Switch Read DANGER and WARNING on page 11-1.

- 1. With Tow switch in the TOW position, disconnect the battery wires (negative cable first) and discharge the controller. See Section 10, Figure 10-1, Page 10-2.
- 2. Disconnect the three wires from the rocker switch. Using a multimeter set to $200~\Omega$ (ohms), place the black lead on the white wire terminal 3 position on the rocker switch, and place the red lead at the red/white wire terminal 2 position. With the switch in NEUTRAL or REVERSE, there should be no continuity. With the switch in FORWARD, there should be continuity. If the readings are incorrect, replace the switch.
- 3. Place the black lead on the blue wire terminal 1 position on the rocker switch and place the red lead on the red/white wire terminal. With the switch in REVERSE, there should be continuity. If the readings are incorrect, replace the switch.
- Reconnect battery cables (positive cable first) and tighten to 110 in-lb (12.4 N-m). Coat with Battery Protector Spray (Club Car Part NO. 1014305) to minimize corrosion.

Test Procedure 17–Reverse Buzzer

Read DANGER and WARNING on page 11-1.

- 1. If the vehicle will not move and the solenoids do not click, place the Forward/Reverse rocker switch in the REVERSE position and listen for the reverse warning buzzer to sound.
 - 1.1. If the buzzer sounds, it is an indication that the Tow/Run switch and the OBC are operating properly and sending a voltage signal to the other components in the electrical system. Test the voltage at the main solenoid activating coil. **See Test Procedure 3.**
 - 1.2. If the buzzer does not sound, the OBC or controller may have failed and should be tested. **See**Test Procedure 2. See also following NOTE.

NOTE

- THE BUZZER WILL NOT SOUND IF IT HAS FAILED. USE THE FOLLOWING PROCEDURE TO TEST THE BUZZER.
- 2. Place Tow/Run switch in the TOW position, disconnect the battery wires (negative cable first) and discharge the controller. See Section 10, Figure 10-1, Page 10-2.
- 3. Remove the center dash:
 - 3.1. Remove the plastic cap covering the screw on each side of the center dash panel. Loosen (but do not remove) these screws.
 - 3.2. Insert screwdriver at the top center of the dash between dash and cowl brace. Gently pry center dash out from under edge of cowl brace.
 - 3.3. Pull dash out approximately one inch from the frame and then bend the top right corner of the dash inward while pulling the top of the panel out and down. **See following NOTE.**

NOTE

- BENDING THE TOP RIGHT CORNER OF THE CENTER DASH INWARD DURING REMOVAL WILL PREVENT THE CONTACTS ON THE BACK OF THE KEY SWITCH FROM TOUCHING THE METAL FRAME AROUND THE DASH.
 - 3.4. Slide the dash panel up the steering column by snapping the top out and then rotating the panel out and up.
 - 3.5. Disconnect the orange and red wires from the buzzer. Make sure the wire terminals on the key switch do not touch vehicle frame.
- 4. Reconnect the battery wires (positive cable first) and tighten to 110 in-lb (12.4 N-m). Coat with Battery Protector Spray (Club Car Part No. 1014305) to minimize corrosion.
- 5. Place the Forward/Reverse rocker switch in REVERSE.
- 6. Using a multimeter set to 200 volts DC, place the black lead on battery No. 6 negative post and place the red lead on the red wire terminal end that was disconnected from the reverse buzzer. The reading should be approximately 48 volts (full battery voltage).
 - 6.1. If the voltage reading is correct, proceed to step 7.
 - 6.2. If reading is zero volts, check red wire continuity and voltage output of OBC. **See Test Procedure 2**.
 - 6.3. If the continuity readings are not correct, repair or replace the red wire.
 - 6.4. If the continuity readings are correct, proceed to step 7.
- 7. Place the F&R switch in REVERSE. Using a multimeter set to 200 volts DC, place the black lead on the orange wire terminal end (that was disconnected from the reverse buzzer) and place the red lead on battery No. 1 positive post. The reading should be approximately 48 volts (full battery voltage).
 - 7.1. If the voltage reading is correct in steps 6 and 7, replace the reverse buzzer.
 - 7.2. If reading is zero volts, check orange wire continuity and connection at Pin 10 in 23-Pin connector.
 - 7.3. If there is no continuity in the orange wire, or the Pin 10 terminal in the 23-Pin connector is not properly seated, repair or replace as required.
 - 7.4. If the orange wire continuity and 23-Pin connector are correct and there is no voltage at the orange wire, replace the controller.

Test Procedure 18–Rebooting The Onboard Computer Read DANGER and WARNING on page 11-1.

It is possible the Onboard Computer (OBC) can become "locked up", causing the OBC solenoid lockout circuit to malfunction. If this condition is suspected, restart the computer as follows:

- 1. Place the Tow/Run switch in the TOW position.
- 2. Disconnect the batteries, negative cable first. See Section 10, Figure 10-1, Page 10-2.
- 3. Discharge the controller as instructed in the WARNING on page 11-1.
- 4. Reconnect the batteries, positive cable first, and tighten terminals to 110 in-lb (12.4 N-m).
- 5. Place Tow/Run switch in the RUN position.
- 6. Test drive the vehicle. If the problem has been fixed, the vehicle will function normally. If the problem still exists, refer to the diagnostic flow charts beginning on page 11-12.

Test Procedure 19–Battery Warning Light Read DANGER and WARNING on page 11-1.

- 1. Turn key switch OFF, place Tow/Run switch in TOW and place Forward/Reverse rocker switch in NEUTRAL.
- 2. Disconnect the six-pin connector at the OBC.
- 3. Remove the wedge lock from the six-pin connector housing that is connected to the vehicle wire harness. Remove the brown wire from the connector plug.
- 4. Using a jumper wire with an alligator clip at each end, connect one alligator clip to the negative post of battery No. 1 and the other alligator clip to the brown wire terminal socket that was removed from the six-pin connector plug.
- Install the wedgelock in the six-pin connector housing and reconnect the six-pin connector plug. Place the Tow/Run switch in the RUN position and the battery light should illuminate. If the light does not illuminate, replace the battery warning light assembly.

THE COMMUNICATION DISPLAY MODULE (CDM)

The CDM can be used to retrieve from the onboard computer four important items of information that can be useful in troubleshooting the PowerDrive Plus vehicle. To access one of these items, the item's corresponding Function Code must be selected on the CDM. This is done by pressing the Function Button until the desired function code is displayed in the window. **See Figure 11-17**, **Page 11-27 for CDM features**. Releasing the button when the desired code is displayed will display the data. Function codes and corresponding data are as follows:

• F1 - Battery voltage:

This displays the battery pack's current state of charge. A reading of less than 48 volts indicates that the batteries need to be charged. If a reading of less than 48 volts is obtained immediately after a charge cycle, there may be a problem in the charge circuit.

• F2 - Energy units removed since last charge cycle:

If the display reads over 75 (the vehicle Battery Warning Light should be illuminated), the vehicle batteries need to be recharged before being used again. This data can be used to make sure all vehicles in a fleet receive equal usage on a short term basis.

• F3 – Total accumulated energy units removed since initial vehicle start-up:

This information is most useful in making sure that all vehicles in a fleet receive equal usage over long periods of time.

F4 – Last charge termination type (1 = incomplete, 2 = DVDT, 4 = normal, 8 = max. timer):

- A 1, 2, 4, or 8 will be displayed.
- 1 Indicates the last charge cycle was incomplete and the batteries were not fully charged. Batteries should be charged again at the earliest opportunity.
- 2 Indicates a back-up charge program was employed by the OBC to complete the charge cycle. A DVDT charge may be displayed the first few times a new set of batteries is charged, and the first time a set of batteries is charged after the batteries have been disconnected and reconnected. A problem may exist if persistent DVDT readings are obtained.
- 4 Indicates the last charge cycle was normal.
- 8 Indicates the charger ran for sixteen hours and shut itself off without completing the charge cycle.
 This means there may be a problem in the charge circuit.

The CDM also has a low battery indicator which illuminates when CDM batteries are weak and need to be replaced. Weak batteries in the CDM may cause the CDM to register inaccurate information or no information.

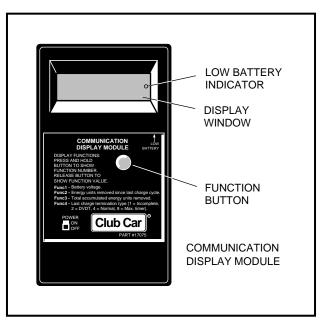


Figure 11-17 CDM

USING THE CDM TO RETRIEVE DATA FROM THE ONBOARD COMPUTER

- 1. Turn the CDM ON.
- 2. Position CDM on seat bottom so it is aligned directly with the battery warning light. Ensure CDM infrared LED receiver is pointed at battery warning light and there is a clear path between them. **See following NOTE**.

NOTE

- IF, BY POSITIONING CDM ON SEAT BOTTOM, THE CDM IS UNABLE TO COLLECT DATA STREAM FROM OBC, HOLD CDM APPROXIMATELY 6 INCHES FROM BATTERY WARNING LIGHT.
- 3. Wait approximately 30 seconds for a value to appear in the display window.
- 4. If a value does not appear in the display window after 30 seconds, try adjusting the aim of the CDM and repeating step 3 until a value appears. If there is still no reading, check for weak batteries in the CDM.

Once a value has been obtained in the display window, the CDM may be removed from its receiving position and the data reviewed. The CDM will hold the values for F1, F2, F3, and F4 until the CDM is turned OFF or it receives another line of data from the same or another onboard computer. Use the following procedure to review the data stored in the CDM:

- The value currently displayed will be F1 (battery voltage).
- To view F2, press and hold the button on the CDM. When "Func 2" appears in the display window, release the button. The value for F2 will then be displayed.
- To view F3, press and hold the button on the CDM until "Func 3" appears in the display window. Release the button. The value for F3 will be displayed.
- To view F4, press and hold the button on the CDM until "Func 4" appears in the display window. Release the button. The value for F4 will be displayed

CDM TROUBLESHOOTING GUIDE

Use the following chart as a starting point for troubleshooting problems with communication between the CDM and onboard computer. Contact your Club Car representative for more comprehensive information.

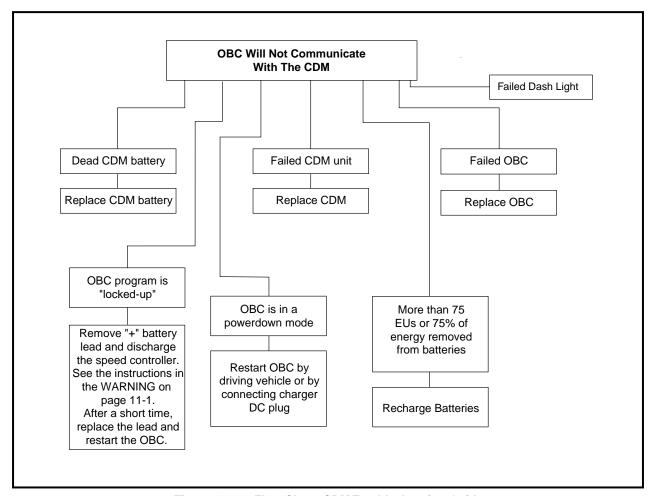


Figure 11-18 Flow Chart-CDM Troubleshooting Guide

SECTION 12-ELECTRICAL COMPONENTS

A DANGER

- BATTERY EXPLOSIVE GASES! DO NOT SMOKE. KEEP SPARKS AND FLAMES AWAY. VENTILATE WHEN CHARGING OR USING IN AN ENCLOSED SPACE. ALWAYS WEAR FULL FACE SHIELD AND RUBBER GLOVES WHEN WORKING ON OR NEAR BATTERIES.
- USE EXTREME CAUTION WHEN USING TOOLS, WIRES, OR METAL OBJECTS NEAR BATTERIES! A SHORT CIRCUIT AND (OR) SPARK COULD CAUSE AN EXPLOSION.
- BATTERY POISON! CONTAINS ACID! CAUSES SEVERE BURNS. AVOID CONTACT WITH SKIN, EYES, OR CLOTHING. ANTIDOTES:
 - EXTERNAL: FLUSH WITH WATER. CALL A PHYSICIAN IMMEDIATELY.
 - INTERNAL: DRINK LARGE QUANTITIES OF MILK OR WATER. FOLLOW WITH MILK OF MAGNESIA OR VEGETABLE OIL. CALL A PHYSICIAN IMMEDIATELY.
 - EYES: FLUSH WITH WATER FOR FIFTEEN MINUTES. CALL PHYSICIAN IMMEDIATELY.

A WARNING

- ONLY TRAINED TECHNICIANS SHOULD REPAIR OR SERVICE THIS VEHICLE. ANYONE DOING EVEN SIMPLE REPAIRS OR SERVICE SHOULD HAVE KNOWLEDGE AND EXPERIENCE IN ELECTRICAL AND MECHANICAL REPAIR.
- FOLLOW ALL PROCEDURES EXACTLY AS STATED IN THIS MANUAL, AND HEED ALL DANGER, WARNING AND CAUTION STATEMENTS, AS WELL AS THOSE AFFIXED TO THE VEHICLE.
- WEAR SAFETY GLASSES OR APPROVED EYE PROTECTION WHILE SERVICING VEHICLE.
- PLACE THE TOW/RUN SWITCH IN THE **TOW** POSITION BEFORE CONNECTING OR DISCONNECTING BATTERY WIRES.
- BEFORE PERFORMING ANY TESTS OR REPAIRS, MAKE SURE CAPACITORS ARE DISCHARGED. PLACE THE TOW/RUN SWITCH IN THE **TOW** POSITION, DISCONNECT BATTERY WIRES, PLACE FORWARD/REVERSE ROCKER SWITCH IN **REVERSE** AND LISTEN FOR THE REVERSE BUZZER:
 - IF THE REVERSE BUZZER DOES NOT SOUND, THE CAPACITORS ARE DISCHARGED.
 - IF THE REVERSE BUZZER SOUNDS, TURN THE KEY SWITCH **ON** AND DEPRESS THE ACCELERATOR PEDAL UNTIL THE BUZZER CAN NO LONGER BE HEARD.
- DO NOT WEAR LOOSE CLOTHING. REMOVE JEWELRY SUCH AS RINGS, WATCHES, CHAINS, ETC. BEFORE SERVICING VEHICLE.
- USE INSULATED TOOLS WHEN WORKING NEAR BATTERIES OR ELECTRICAL CONNECTIONS. USE EXTREME CAUTION TO AVOID SHORTING OF COMPONENTS OR WIRING.
- TO AVOID UNINTENTIONALLY STARTING THE VEHICLE, DISCONNECT BATTERIES AS SHOWN IN **FIGURE 12-1**, **PAGE 12-2** WHEN PERFORMING TESTS THAT DO NOT REQUIRE THE ELECTRICAL SYSTEM TO BE ENERGIZED.

A CAUTION

• IF WIRES ARE REMOVED OR REPLACED MAKE SURE WIRING AND/OR WIRING HARNESS IS PROPERLY ROUTED AND SECURED TO VEHICLE FRAME. FAILURE TO PROPERLY ROUTE AND SECURE WIRING COULD RESULT IN VEHICLE MALFUNCTION, PROPERTY DAMAGE OR PERSONAL INJURY.

12 ELECTRICAL COMPONENTS Key Switch

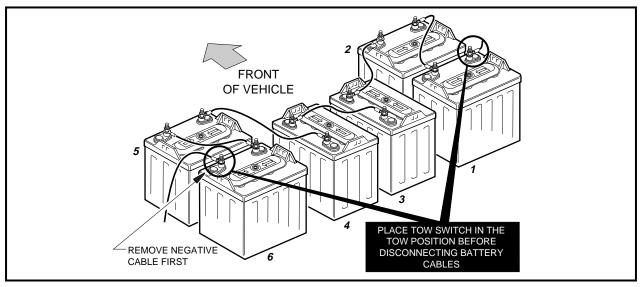


Figure 12-1 PowerDrive Plus Battery Configuration

KEY SWITCH

Read DANGER and WARNING above.

The key switch is mounted next to the steering column on the center dash panel.

Testing The Key Switch

See Test Procedure 9, Section 11, Page 11-20.

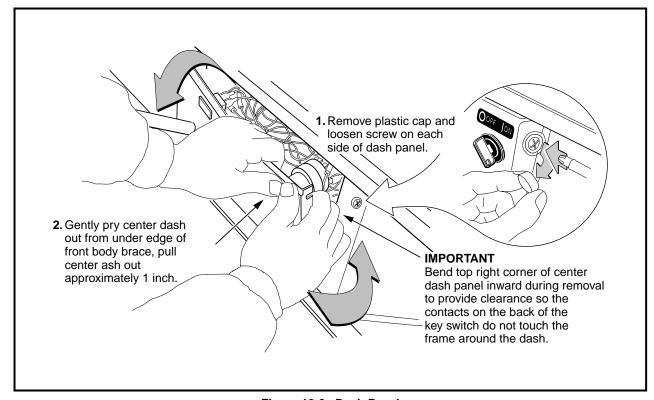


Figure 12-2 Dash Panel

Key Switch Removal

1. Place Tow/Run switch in the TOW position and disconnect batteries (Figure 12-1, Page 12-2). See DANGER and WARNING on page 12-1.

- 2. Discharge the speed controller. See instructions in WARNING on Page 12-1.
- 3. Remove center dash.
 - 3.1. Remove the plastic cap covering the screw on each side of the center dash (Figure 12-2, Page 12-2).
 - 3.2. Loosen (but do not remove) the screw on each side of the center dash panel.
 - 3.3. Insert screwdriver at top center of center dash between dash and cowl brace. Gently pry center dash out from under edge of cowl brace.
 - 3.4. Pull center dash out approximately one inch from the frame and then bend the top right corner of the center dash panel inward while pulling the top of the panel out and down. See following NOTE.

NOTE

- BENDING THE TOP RIGHT CORNER OF THE CENTER DASH INWARD DURING REMOVAL WILL PREVENT THE TERMINALS (7) ON THE BACK OF THE KEY SWITCH FROM TOUCHING THE METAL FRAME AROUND THE DASH (FIGURE 12-3, PAGE 12-3).
- 4. Slide center dash panel up steering column by snapping top out and then rotating the panel out and up.
- 5. Disconnect the wires from the key switch. Do not allow wires to touch.
- 6. From the back of the dash panel, push down on the retaining tabs surrounding the key switch (4) and remove the key switch cap (8). Hold the key switch and remove the switch retaining nut (6) from the outside of the dash panel (Figure 12-3, Page 12-3).

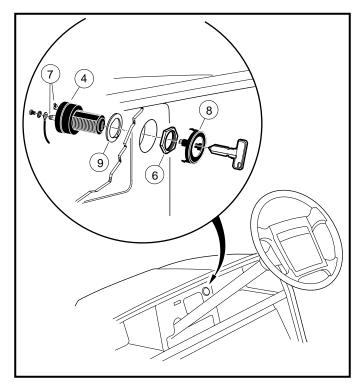


Figure 12-3 Key Switch

Key Switch Installation

- 1. Position the key switch and flat washer (9) in the center dash, then install and tighten the switch retaining nut (6) to 40 in-lb (4.5 N-m). Install key switch cap (8) in center dash (Figure 12-3, Page 12-3).
- Connect the wires to the key switch terminals and tighten the terminal screws to 7 in-lb (.8 N-m). See Section 11, Figure 11-3, Page 11-4. Coat the terminals with Battery Protector Spray (Club Car Part No. 1014305).
- 3. Install center dash by reversing removal procedure. Make sure key switch terminals (7) do not touch frame and that the center dash panel is properly seated and snapped into place (Figure 12-3, Page 12-3).
- 4. Reconnect battery wires (positive wire first) and tighten to 110 in-lb (12.4 N-m). Place Tow/Run switch in RUN.

FORWARD/REVERSE (F&R) ROCKER SWITCH

Read DANGER and WARNING on page 12-1.

Testing the Forward/Reverse rocker switch

See Test Procedure 16, Section 11, Page 11-24.

Forward/Reverse (F&R) Rocker Switch Removal

- 1. Remove three self tapping screws (3) that hold F&R rocker switch case (2) to body (Figure 12-4, Page 12-4).
- 2. Remove red/white (4), blue (5), and white (6) 18 gauge wires from rocker switch (Figure 12-4, Page 12-4).
- 3. Depress locking tabs (1) on each end of switch and push switch out of case (Figure 12-4, Page 12-4).

Forward/Reverse (F&R) Rocker Switch Installation

- Depress locking tabs (1) on each end of switch and push switch into case (Figure 12-4, Page 12-4).
- 2. Connect red/white (4), blue (5), and white (6) 18 gauge wires to rocker switch (Figure 12-4, Page 12-4).
- 3. Install the three self tapping screws (3) that hold the F&R rocker switch case (2) to the body (Figure 12-4, Page 12-4). Tighten to 20 in-lb (2.2 N-m).

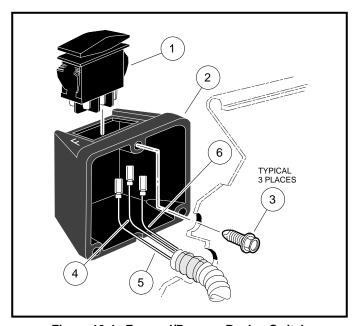


Figure 12-4 Forward/Reverse Rocker Switch

ACCELERATOR PEDAL LIMIT SWITCH

Read DANGER and WARNING on page 12-1.

Testing the Accelerator Pedal Limit Switch

See Test Procedure 9, Section 11, Page 11-20.

Accelerator Pedal Limit Switch Removal

- 1. Place Tow/Run switch in the TOW position, disconnect batteries (negative cable first) (Figure 12-1, Page 12-2) and discharge speed controller.
- 2. Remove the No. 5 and No. 6 batteries from the vehicle.
- 3. Remove the cover from the wiper switch housing.
- 4. Disconnect the accelerator rod from the ball stud on the wiper switch.
- 5. Remove and retain the screws, lock washers, and nuts attaching the limit switch to the wiper switch.
- 6. Disconnect the green/white and blue wires from the limit switch.

Accelerator Pedal Limit Switch Installation

- 1. Position the Accelerator Pedal Limit switch on the wiper switch body and install the mounting screws, lock washers, and nuts. Tighten the screws to 5 in-lb (0.6 N-m).
- 2. Connect the accelerator rod ball joint to the ball stud on the wiper switch.
- 3. Connect the green/white wire to the normally closed (NC) terminal and the blue wire to the common (COM) terminal of the limit switch. The normally open (NO) terminal should have *no* wire attached.
- 4. Install the cover on the wiper switch (make sure all three tabs snap into place).
- 5. Install and connect the No. 5 and No. 6 batteries, leaving the No. 6 negative (–) post disconnected.
- 6. Connect battery cables to battery No. 1 positive (+) first, then connect cable to battery No. 6 negative (–). Tighten terminals to 110 in-lb (12.4 N-m).
- 7. Place Tow/Run switch in RUN.

REVERSE BUZZER

Read DANGER and WARNING on page 12-1.

Testing the Reverse Buzzer

See Test Procedure 17, Section 11, Page 11-24.

Reverse Buzzer Removal

- 1. Place Tow/Run switch in the TOW position, disconnect batteries (Figure 12-1, Page 12-2) and discharge speed controller.
- 2. Remove center dash. See Remove Center Dash, page 12-2.
- 3. Disconnect the 18 gauge red and orange wires from reverse buzzer.
- 4. Remove the two screws from the reverse buzzer. Remove the reverse buzzer from the center dash panel.

Reverse Buzzer Installation

- 1. Install the reverse buzzer in the reverse order of removal. Tighten screws to 4 in-lb (0.45 N-m).
- 2. Reconnect battery wires (positive cable first) and tighten to 110 in-lb (12.4 N-m). Place Tow/Run switch in the RUN position.

2 ELECTRICAL COMPONENTS Main Solenoid

MAIN SOLENOID

Read DANGER and WARNING on page 12-1.

The main solenoid is located on the passenger side of the electrical component mounting plate.

Testing the Main Solenoid

See Test Procedure 3, Section 11, Page 11-17.

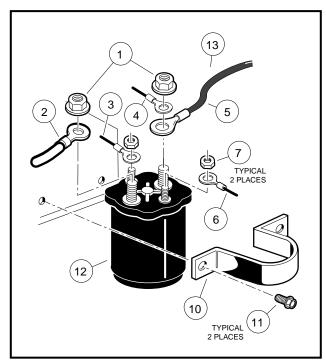


Figure 12-5 Main Solenoid

Main Solenoid Removal

- 1. Place Tow/Run switch in the TOW position and disconnect batteries. See Figure 12-1, Page 12-2.
- 2. Remove the rear body access door.
- 3. Disconnect all wires from the solenoid (12) (Figure 12-5, Page 12-6).
- 4. Loosen, but do not remove, one of the thread rolling screws (11) that hold the solenoid mounting bracket (10) to the component mounting plate (Figure 12-5, Page 12-6).
- 5. Lift the solenoid (12) up and out of the mounting bracket (10) (Figure 12-5, Page 12-6).

Main Solenoid Installation

- 1. Mount solenoid (12) onto component mounting plate with mounting bracket (10) (Figure 12-5, Page 12-6).
- 2. Tighten thread rolling screws (11) to 20 in-lb (2.2 N-m) (Figure 12-5, Page 12-6).
- 3. Install wires (2, 4 and 13) and lock nuts (1) onto large mounting posts. Tighten nuts to 60 in-lb (6.7 N-m) (Figure 12-5, Page 12-6). See Section 11, Figure 11-1, Page 11-2 for wire destinations.
- 4. Install wires (3 and 6) and nuts (7) onto small mounting posts. Tighten to 18 in-lb (2.0 N-m) (Figure 12-5, Page 12-6).
- 5. Install rear body access door.
- Connect batteries (positive cable first) (Figure 12-1, Page 12-2) and tighten to 110 in-lb (12.4 N-m).
 Place Tow/Run switch in RUN.

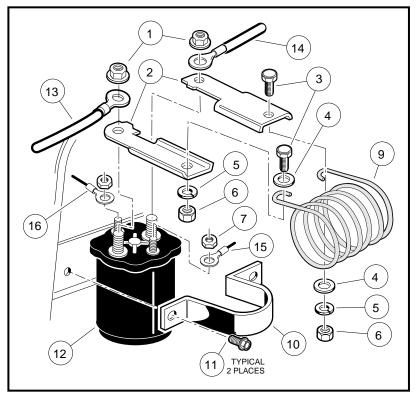


Figure 12-6 Dynamic Braking Solenoid

DYNAMIC BRAKING SOLENOID

Read DANGER and WARNING on page 12-1.

The dynamic braking solenoid is located on the driver side of the electrical component mounting plate.

Testing the Dynamic Braking Solenoid

See Test Procedure 8, Section 11, Page 11-19.

Dynamic Braking Solenoid Removal

- 1. Place Tow/Run switch in the TOW position, disconnect the batteries and discharge the controller (Figure 12-1, Page 12-2).
- 2. Remove the rear body access door.
- 3. Disconnect all wires from the solenoid (12) (Figure 12-6, Page 12-7).
- 4. Loosen, but do not remove, one of the self tapping screws (11) that hold the solenoid mounting bracket (10) to the component mounting plate (Figure 12-6, Page 12-7).
- 5. Lift the solenoid (12) up and out of the mounting bracket (10) (Figure 12-6, Page 12-7).

Dynamic Braking Solenoid Installation

- 1. Mount solenoid onto component mounting plate with mounting bracket (10) (Figure 12-6, Page 12-7).
- 2. Tighten thread rolling screws (11) to 60 in-lb (6.7 N-m) (Figure 12-6, Page 12-7).
- 3. Install mounting tabs (2), wires (13, 14) and flanged lock nuts (1) onto large mounting posts. Tighten nuts to 60 in-lb (6.7 N-m) (Figure 12-6, Page 12-7). See Section 11, Figure 11-3, Page 11-4 for correct wire destinations.
- 4. Install wires (15, 16) and nuts (7) onto small mounting posts. Tighten nuts to 18 in-lb (2.0 N-m) (Figure 12-6, Page 12-7).

12 ELECTRICAL COMPONENTS Onboard Computer (OBC)

Dynamic Braking Soienoid Installation, Continued:

- 5. Install rear body access door.
- 6. Connect batteries (positive cable first) and tighten to 110 in-lb (12.4 N-m) (Figure 12-1, Page 12-2). Place Tow/Run switch in RUN.

ONBOARD COMPUTER (OBC)

Read DANGER and WARNING on page 12-1.

Testing the Onboard Computer

See Test Procedures 2, 11 and 12, Section 11, Page 11-16, Page 11-22 and Page 11-22.

Onboard Computer Removal

- 1. Place Tow/Run switch in the TOW position and disconnect the batteries (Figure 12-1, Page 12-2).
- 2. Remove rear body access door and unplug six-pin connector (16) at OBC (Figure 12-7, Page 12-8).
- 3. Remove black 10 gauge and 6 gauge wires (9 and 14) from controller B- terminal (Figure 12-7, Page 12-8).
- 4. Disconnect the gray wire fuse holder at the charger receptacle.
- 5. Disconnect the black 10 gauge wire (8) at the charger receptacle.
- 6. Cut the wire tie that secures the OBC wire harness to the I-beam.
- Loosen, do not remove, self tapping screws (17) holding OBC to component mounting plate (Figure 12-7, Page 12-8).
- Slide OBC towards outside of vehicle and align heads of self tapping screws (17) with the two holes in the OBC face plate (Figure 12-7, Page 12-8). Pull OBC towards rear of vehicle and remove from component mounting plate.

Onboard Computer Installation

- 1. Place Tow/Run switch in the TOW position and disconnect the batteries (Figure 12-1, Page 12-2).
- 2. Remove the rear body access door.
- Install OBC onto component mounting plate by aligning two holes on OBC face plate with two holes on component mounting plate. Slide OBC towards inside of vehicle and align heads of self tapping screws (17) with smaller part of two holes in OBC face plate (Figure 12-7, Page 12-8). Tighten screws to 60 in-lb (6.7 N-m).

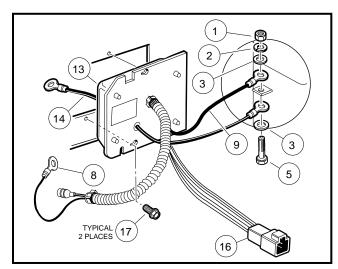


Figure 12-7 Onboard Computer

- 4. Attach wire tie so the OBC wire harness is secured to the I-beam.
- 5. Connect the black 10 gauge wire (8) to the charger receptacle.
- 6. Connect the gray wire fuse holder to the charger receptacle.
- 7. Connect black 10 and 6 gauge wires (9 and 14) to controller B- terminal (Figure 12-7, Page 12-8).
- 8. Plug the six-pin connector (16) into the OBC (Figure 12-7, Page 12-8).
- 9. Install the rear body access door.
- 10. Reconnect battery cables (positive cable first) and tighten to 110 in-lb (12.4 N-m) (Figure 12-1, Page 12-2). Place Tow/Run switch in RUN.

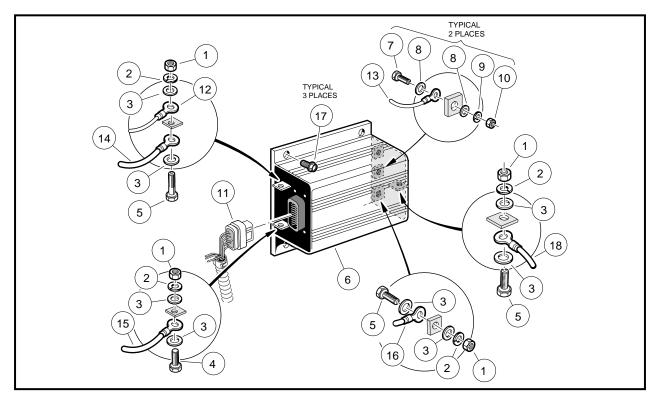


Figure 12-8 Speed Controller

SOLID STATE SPEED CONTROLLER

Read DANGER and WARNING on page 12-1.

Testing the Solid State Speed Controller

See Test Procedure 5, Section 11, Page 11-18.

Speed Controller Removal

- 1. Place Tow/Run switch in the TOW position and disconnect the batteries. See Figure 12-1, Page 12-2.
- 2. Remove the rear body access door.
- 3. Disconnect all wires from the speed controller (6) (Figure 12-8, Page 12-9).
- 4. Remove the three self tapping screws (17) that hold the controller (6) to the component mounting plate and remove the controller from the vehicle (Figure 12-8, Page 12-9).

Speed Controller Installation

1. Install the three self tapping screws (17) that hold the controller (6) to the component mounting plate and tighten to 60 in-lb (6.7 N-m) (Figure 12-8, Page 12-9).

2 ELECTRICAL COMPONENTS Charger Receptacle

Speed Controller Installation, Continued:

- 2. Install wires (12, 13, 14, 15, 16 and 18) as illustrated in Figure 12-8, Page 12-9. Tighten nuts (1) to 9 ft-lb (12.2 N-m). Tighten nut (10) to 32 in-lb (3.6 N-m). See Section 11, Figure 11-3, Page 11-4 for wire destinations.
- 3. Install rear body access door.
- 4. Reconnect battery cables (positive cable first) and tighten to 110 in-lb (12.4 N-m) (Figure 12-1, Page 12-2). Place Tow/Run switch in RUN.

CHARGER RECEPTACLE

Read DANGER and WARNING on page 12-1.

The charger receptacle and DC cord and plug are wear items that should be inspected daily. They *must* be replaced when worn or damaged. If the charger plug and receptacle show signs of corrosion or are becoming difficult to insert and remove, the receptacle contacts and plug blades can be cleaned with a good electrical contact cleaner or lightly sprayed with WD-40[®] brand spray lubricant.

Testing the Charger Receptacle

See Section 14, Test Procedure 1, Page 14-12.

See also Section 11, Test Procedure 13, Page 11-22.

Charger Receptacle Inspection

Inspect the receptacle for cracks, loose connections and frayed wiring.

NOTE

• DISASSEMBLY OF THE CHARGER RECEPTACLE, FOR THE PURPOSE OF REMOVAL OR INSTALLATION, IS NOT RECOMMENDED.

Charger Receptacle Removal

- 1. Place Tow/Run switch in the TOW position and disconnect the batteries. **See Figure 12-1, Page 12-2.**
- 2. Remove the 10 gauge red wire (4) from the positive post of battery No. 1 (Figure 12-9, Page 12-11).
- 3. Remove black 10 gauge OBC wire (5) from charger receptacle assembly (Figure 12-9, Page 12-11).
- 4. Disconnect the gray wire (9) from the receptacle at the yellow fuse holder (Figure 12-9, Page 12-11).
- 5. Remove the four screws (1) that secure the charger receptacle bezel (8) to the receptacle backing plate and to the vehicle body (Figure 12-9, Page 12-11).
- 6. Move the receptacle assembly toward the front of the vehicle and tilt receptacle upwards in order for the receptacle to pass through the hole in the vehicle body.

Charger Receptacle Installation

- 1. Insert the 10 gauge red wire (4) and the 18 gauge gray wire (3) through the hole in the vehicle body and the receptacle backing plate (Figure 12-9, Page 12-11).
- 2. Insert receptacle into vehicle body.
- 3. Install the four screws (1) that secure the receptacle assembly to the vehicle body and receptacle backing plate (8). Tighten screws to 11 in-lb (1.2 N-m) (Figure 12-9, Page 12-11).
- 4. Connect 18 gauge gray wire (9) to yellow fuse holder. Make sure fuse (11) is installed in fuse holder.
- 5. Connect the 10 gauge black wire (5) to the receptacle fuse link (6) on the charger receptacle assembly (Figure 12-9, Page 12-11).

- 6. Connect the 10 gauge red wire (4) to the positive post of battery No. 1.
- 7. Connect battery cables (positive cable first) and tighten to 110 in-lb (12.4 N-m) (Figure 12-1, Page 12-2). Place Tow/Run switch in RUN.

RECEPTACLE FUSE LINK

The fuse link on the PowerDrive Plus vehicle should not blow under normal operating conditions. However, if the fuse link has blown, the vehicle will not charge and the fuse must be replaced. The fuse link is mounted on top of the charger receptacle in the battery compartment.

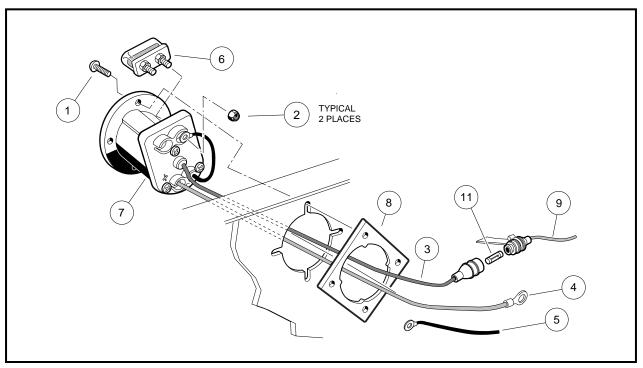


Figure 12-9 Charger Receptacle

Receptacle Fuse Link Removal

- 1. Remove the fuse link assembly (6) from the charger receptacle (7) by removing the two nuts and washers used to secure the 10 gauge black wire from the computer (5) and the 10 gauge black wire to the receptacle (Figure 12-9, Page 12-11).
- 2. Remove the fuse link (6) from the charger receptacle (Figure 12-9, Page 12-11).

Receptacle Fuse Link Installation

- 1. Insert the two fuse link mounting posts into the mounting holes in the charger receptacle.
- 2. Place the two 10 gauge black wires in their original positions on the fuse link mounting posts.
- Install nuts (2) on fuse link mounting posts and tighten to 19 in-lb (2.1 N-m) (Figure 12-9, Page 12-11).

MULTI-STEP POTENTIOMETER

Read DANGER and WARNING on page 12-1.

Testing the Multi-Step Potentiometer

See Section 11, Test Procedure 4, Page 11-17.

ELECTRICAL COMPONENTS Multi-Step Potentiometer

Multi-Step Potentiometer Removal

- 1. Place Tow/Run switch in the TOW position and disconnect the batteries (Figure 12-1, Page 12-2).
- 2. Remove the battery wire connecting batteries No. 5 and No. 6 and the battery wire connecting batteries No. 5 and No. 4 (Figure 12-1, Page 12-2).
- 3. Remove the hold-down bracket from the No. 5 and No. 6 batteries and then remove the No. 5 and No. 6 batteries from the vehicle (Figure 12-1, Page 12-2).
- 4. Slide back the ball stud retainer on the potentiometer end of the accelerator rod (1) and disconnect the accelerator rod from the multi-step potentiometer (Figure 12-10, Page 12-13).
- 5. Disconnect the three-pin connector (2), the blue wire and the green/white wire from the wire harness, at the multi-step potentiometer (Figure 12-10, Page 12-13).
- 6. Remove the nuts (6) and washers (7) from underneath the I-Beam and lift the multi-step potentiometer assembly from the frame. Remove the shim plate (8) (Figure 12-10, Page 12-13).

Multi-Step Potentiometer Disassembly

- 1. Remove nuts (30) and slide bolt (29) out of potentiometer housing (Figure 12-13, Page 12-16).
- 2. Remove the nut (32) and bell crank (34) (Figure 12-13, Page 12-16).
- 3. Slide the wiper arm assembly out of the housing (1) (Figure 12-13, Page 12-16).
- 4. Disassemble the wiper arm assembly: Unscrew the adjustment screw (23) and retainer nut (19), and remove the spring (21) (Figure 12-13, Page 12-16).
- 5. To remove the bearings (22) (Figure 12-13, Page 12-16) lightly tap them from the back with a punch.

Multi-Step Potentiometer Assembly

- 1. Install bearings (22) into the potentiometer housing by lightly tapping them with a plastic hammer. Make sure the collars of the bearings are flush against the housing (Figure 12-13, Page 12-16).
- With spring (21) in place, hold wiper arm (26) and carrier (20) together (Figure 12-13, Page 12-16). See following CAUTION.

A CAUTION

- MAKE SURE THE SPRING IS IN THE RECESSED AREA OF THE WIPER ARM. IF THE SPRING IS NOT IN PLACE, THE WIPER ARM MAY BREAK IF FORCED.
- 3. Install the adjustment screw (23) and a new nylon lock nut (19) (Figure 12-13, Page 12-16).

NOTE

- WIPER ARM SHOULD BE ADJUSTED AFTER THE POTENTIOMETER IS FULLY ASSEMBLED.
- 4. Slide the wiper arm assembly (20) into the potentiometer housing and install the bell crank (34). If ball stud (33) was removed, insert it through the bell crank with ball stud facing down and away from housing and install the nut (35). While holding ball stud with a wrench, tighten the nut to 5 ft-lb (7 N-m) (Figure 12-13, Page 12-16).
- 5. While holding the bell crank so the arm does not exert a load on the housing, install the nut (32) and tighten to 9 ft-lb (12 N-m) (Figure 12-13, Page 12-16).
- 6. Install screw (29), lock washer (9), and nut (30) through potentiometer housing (Figure 12-13, Page 12-16).
- 7. Install nuts (30) and yellow 18 gauge wire (8) onto the screw and tighten to 40 in-lb (4.5 N-m).

A WARNING

- MAKE SURE WIPER ARM ROTATES FREELY IN POTENTIOMETER HOUSING. IF ARM BINDS OR STICKS, IT MUST BE REPLACED.
- 8. Adjust the potentiometer arm. See Page 12-14.

Multi-Step Potentiometer Installation

A CAUTION

• BEFORE INSTALLING THE WIPER SWITCH, INSPECT THE HOUSING FOR CRACKS OR DAMAGE. IF THE HOUSING IS DAMAGED, THE ENTIRE HOUSING WITH FIXED CONTACTS MUST BE REPLACED.

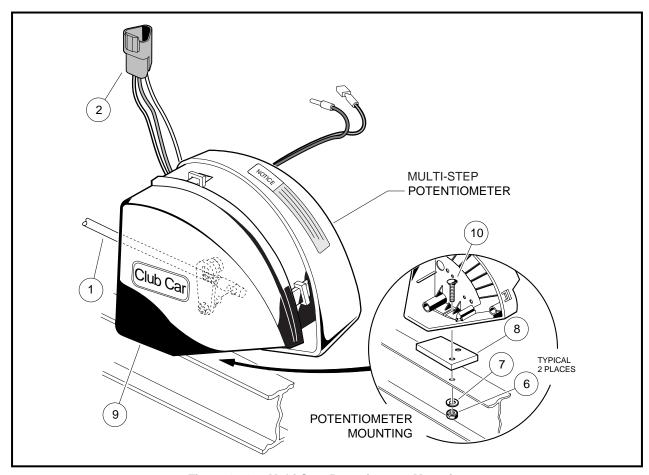


Figure 12-10 Multi-Step Potentiometer Mounting

- 1. Position shim plate (8) on frame I-Beam with mounting holes properly aligned (Figure 12-10, Page 12-13).
- 2. Push locking tabs out of retainers, and remove potentiometer cover (9) (Figure 12-10, Page 12-13).
- 3. Position the potentiometer on the shim plate and frame with mounting holes aligned and insert the mounting bolts (10) through the potentiometer base, the shim plate, and the frame as shown (Figure 12-10, Page 12-13).
- 4. Hold the mounting bolts in place while installing the washers (7) and nuts (6). Tighten nuts to 36 in-lb (4.1 N-m) (Figure 12-10, Page 12-13).

2 ELECTRICAL COMPONENTS Multi-Step Potentiometer

Multi-Step Potentiometer Installation, Continued:

WARNING

 AFTER INSTALLING THE WIPER SWITCH, MAKE SURE IT IS SECURELY FASTENED TO THE VEHICLE FRAME.

- 5. Connect the three-pin connector, blue wire and the green/white wire at the multi-step potentiometer to the wire harness.
- 6. Connect the accelerator rod (1) to the potentiometer (Figure 12-10, Page 12-13).
- 7. Make sure wiper contact is positioned squarely on the last stationary contact when the accelerator pedal is depressed; otherwise, top vehicle speed will not be achieved.
- 8. Make sure wiper switch and pedal group are properly adjusted. See Section 5-Accelerator and Brake Pedal Group in the Maintenance and Service Manual.
- 9. Install and connect the No. 5 and No. 6 batteries leaving the No. 6 negative (–) post disconnected. Tighten terminals to 110 in-lb (12.4 N-m).
- 10. Reconnect battery cables to battery No. 1 positive (+) first, then connect cable to battery No. 6 negative (–). Tighten terminals to 110 in-lb (12.4 N-m). Place the Tow/Run switch in the RUN position.
- 11. Drive the vehicle and inspect it for proper operation.

A CAUTION

• DO NOT OPERATE VEHICLE WITHOUT WIPER SWITCH COVER IN PLACE. OPERATING THE VEHICLE WITHOUT THE COVER ALLOWS DIRT, DUST, AND WATER TO CONTAMINATE THE WIPER SWITCH, WHICH COULD CAUSE THE SWITCH TO FAIL OR MALFUNCTION.

Multi-Step Potentiometer Arm Adjustment

The contact surfaces on the multi-step potentiometer arm brush and fixed contacts must be parallel to ensure efficient operation of the multi-step potentiometer (Figure 12-11, Page 12-15). Adjust arm contact as follows:

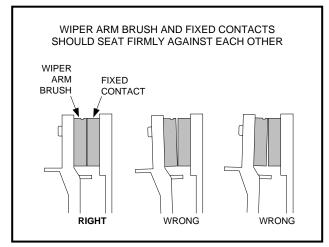
- Place Tow/Run switch in the TOW position and disconnect battery cables, negative cable first (Figure 12-1, Page 12-2). Remove the No. 5 and No. 6 batteries from the vehicle and remove the cover from the multi-step potentiometer.
- 2. Test the multi-step potentiometer arm and fixed contacts for proper adjustment:
 - 2.1. With a dry erase marker, completely coat each of the fixed contacts.
 - 2.2. Sweep the multi-step potentiometer arm brush back and forth across the fixed contacts. Scraping of the ink should show contact on at least 30% of the surface on each fixed contact. If 30% contact is not shown, surface contact should be adjusted.
- To adjust surface contact, turn the adjustment screw (23) (Figure 12-13, Page 12-16) until the surfaces
 of the multi-step potentiometer arm brush and fixed contacts are parallel (Figure 12-11, Page 12-15).
 See following NOTE.

NOTE

- IF THE MULTI-STEP POTENTIOMETER ARM BRUSH IS WORN TO OR BEYOND THE WEAR LIMIT LINE (FIGURE 12-12, PAGE 12-15) IT SHOULD BE REPLACED. IF ANY OF THE FIXED CONTACTS ARE EXCESSIVELY WORN, PITTED, OR BURNED, THE ENTIRE HOUSING, WITH FIXED CONTACTS, MUST BE REPLACED.
- A THREAD LOCKING COMPOUND HAS BEEN PLACED ON THE THREADS OF THE CONTACT STUDS TO PREVENT REMOVAL OF THE FIXED CONTACTS.

Multi-Step Potentiometer Arm Brush Replacement

- 1. Place Tow/Run switch in the TOW position and disconnect battery cables, negative cable first.
- 2. Remove battery Nos. 5 and 6 from the vehicle (Figure 12-1, Page 12-2).
- 3. Disconnect accelerator rod from ball stud and place the wiper switch arm on the topmost fixed contact.
- 4. Remove the first nut (30), and lock washer (9) from the bolt (29) and remove the 18 gauge yellow wire (8) (Figure 12-13, Page 12-16).



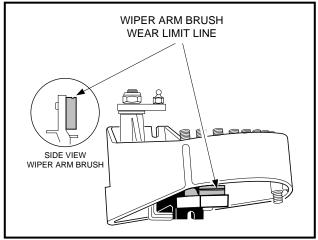


Figure 12-11 Wiper Arm Brush and Fixed Contacts

Figure 12-12 Wiper Arm Brush Wear Limit Line

- 5. Remove the second and third nuts (30) from the bolt (29) and then remove the bolt from the potentiometer housing (1) (Figure 12-13, Page 12-16).
- Remove the fourth nut (30) and wire (42) from the bolt (29) (Figure 12-13, Page 12-16).
- 7. Replace the wiper arm brush (27) as follows (Figure 12-13, Page 12-16).
 - 7.1. Remove screw (25) and lock washer (14). Pull arm assembly away from fixed contacts (Figure 12-13, Page 12-16).
 - 7.2. Remove the brush by pulling the wire through the hole in the wiper arm.
 - 7.3. Install new wiper arm brush assembly (27) (Figure 12-13, Page 12-16).
 - 7.4. Install screw (25) and lock washer (14) through wiper arm into brush. Tighten screw to 7 in-lb (0.8 N-m) (Figure 12-13, Page 12-16).
- 8. Install arm brush wire terminal (42) onto the bolt (29) and then install the nut (30). Thread the nut against the arm brush wire terminal and tighten it to 40 in-lb (4.5 N-m) (Figure 12-13, Page 12-16).
- 9. Install the bolt (29) through the potentiometer housing (1) and then install the two nuts (30) onto the bolt. Tighten the nuts to 40 in-lb (4.5 N-m) (Figure 12-13, Page 12-16).
- 10. Install the 18 gauge yellow wire onto the bolt (29), then install the lock washer (9) and nut (30). Tighten nut to 40 in-lb (4.5 N-m) (Figure 12-13, Page 12-16).
- 11. Connect the accelerator rod to the ball stud.
- 12. Check wiper arm brush contact for proper adjustment. See Page 12-14.
- 13. Check accelerator and brake pedal adjustment. See Section 5–Accelerator and Brake Pedal Group in the Maintenance and Service Manual.
- 14. Install potentiometer cover and install and connect the No. 5 and No. 6 batteries leaving the No. 6 negative (–) post disconnected. Tighten terminals to 110 in-lb (12.4 N-m).
- 15. Reconnect battery cables to battery No. 1 positive (+) first, then connect cable to battery No. 6 negative (–). Tighten terminals to 110 in-lb (12.4 N-m). Place the Tow/Run switch in the RUN position.

12 ELECTRICAL COMPONENTS Multi-Step Potentiometer

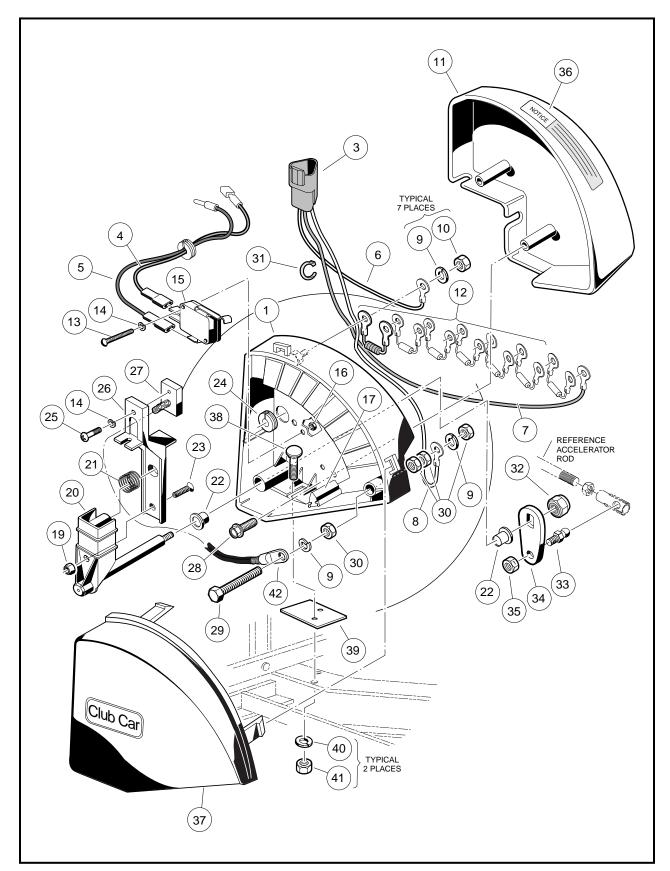


Figure 12-13 Multi-Step Potentiometer

Multi-Step Potentiometer Adjustment

Each of the adjustments listed in the following WARNING affects multi-step potentiometer adjustment. To ensure proper vehicle operation, if any one item requires adjustment, all must be checked, and adjusted if necessary, in the order listed.

A WARNING

- TO PROPERLY ADJUST MULTI-STEP POTENTIOMETER, CHECK, AND ADJUST IF NECESSARY, THE FOLLOWING ITEMS *IN THE ORDER LISTED*:
 - BRAKE PEDAL AND CABLE ADJUSTMENT. SEE SECTION 5-ACCELERATOR AND BRAKE PEDAL GROUP IN MAINTENANCE AND SERVICE MANUAL.
 - ACCELERATOR ROD ADJUSTMENT. SEE SECTION 5-ACCELERATOR AND BRAKE PEDAL GROUP IN MAINTENANCE AND SERVICE MANUAL.
 - ACCELERATOR PEDAL STOP ADJUSTMENT. SEE SECTION 5-ACCELERATOR AND BRAKE PEDAL GROUP IN MAINTENANCE AND SERVICE MANUAL.
 - PARK BRAKE ADJUSTMENT. SEE SECTION 5-ACCELERATOR AND BRAKE PEDAL GROUP IN MAINTENANCE AND SERVICE MANUAL.
- FAILURE TO CHECK ALL ADJUSTMENTS IN THE ORDER LISTED COULD RESULT IN IMPROPER VEHICLE OPERATION, PROPERTY DAMAGE, OR SEVERE PERSONAL INJURY.

RESISTORS

Resistor Removal

- 1. Push locking tabs out of the retainers and remove multi-step potentiometer cover (1) (Figure 12-14, Page 12-18).
- 2. Remove the two thread-rolling screws (32) and resistor protector cover (39) from the multi-step potentiometer (Figure 12-14, Page 12-18).
- 3. Remove the eight 1/4-20 hex nuts securing the resistors to the multi-step potentiometer.
- 4. Remove the seven resistors from the multi-step potentiometer.

Resistor Installation

- 1. Install the purple wire (24) on the second threaded post (Figure 12-14, Page 12-18).
- 2. Install the zero Ω (ohm) resistor (23) (one black color band) onto the second and third threaded posts.
- 3. Install the 910 Ω (ohm) resistor assembly (26) (color bands white, brown, and gold) onto the third and fourth threaded posts (Figure 12-14, Page 12-18). See following NOTE.

NOTE

- THE COLOR BANDS ON THE RESISTORS DO NOT NEED TO BE ORIENTED IN ANY PARTICULAR DIRECTION WHEN INSTALLED.
- 4. Install the 750 Ω (ohm) resistor assembly (27) (color bands violet, green, brown, and gold) onto the fourth and fifth threaded posts (Figure 12-14, Page 12-18).
- 5. Install the 910 Ω (ohm) resistor assembly (28) (color bands white, brown and gold) onto the fifth and sixth threaded posts (**Figure 12-14**, **Page 12-18**).
- 6. Install the 1000 Ω (ohm) resistor assembly (29) (color bands brown, black, red, and gold) onto the sixth and seventh threaded posts (Figure 12-14, Page 12-18).

12 ELECTRICAL COMPONENTS Battery Warning Light

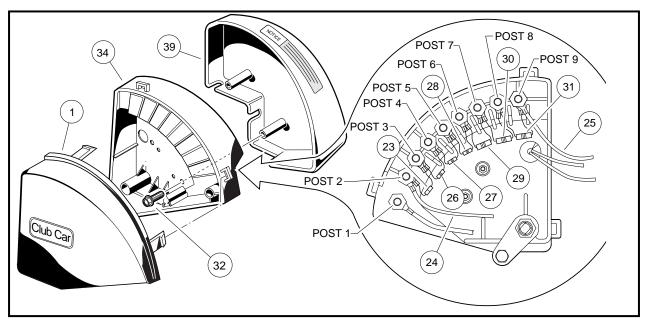


Figure 12-14 Resistors

- 7. Install the 1000 Ω (ohm) resistor assembly (30) (color bands brown, black, red, and gold) onto the seventh and eighth threaded posts (**Figure 12-14**, **Page 12-18**).
- 8. Install the 1000 Ω (ohm) resistor assembly (31) (color bands brown, black, red, and gold) onto the eighth and ninth threaded posts (Figure 12-14, Page 12-18).
- 9. Make sure the purple wire (24) is connected to the second threaded post and the white/black wire (25) is connected to the ninth threaded post (Figure 12-14, Page 12-18).

WARNING

- MAKE SURE WIRES ARE CONNECTED TO WIPER SWITCH CONTACTS EXACTLY AS STATED. IF THEY ARE NOT, THE VEHICLE COULD START IN A SPEED OTHER THAN FIRST.
- 10. Install the eight 1/4-20 hex nuts onto the threaded posts (with resistors attached) and tighten to 40 in-lb (4.5 N-m) (Figure 12-14, Page 12-18).
- 11. Coat all terminals with Battery Protector Spray (Club Car Part Number 1014305) to minimize corrosion.
- 12. Install both of the plastic wiper switch covers (1 and 39) (Figure 12-14, Page 12-18).

BATTERY WARNING LIGHT

Read DANGER and WARNING on page 12-1.

Testing the Battery Warning Light

See Section 11, Test Procedure 19, Page 11-26.

Battery Warning Light Removal

- 1. Place Tow/Run switch in TOW and disconnect the battery wires as shown (Figure 12-1, Page 12-2).
- 2. Remove center dash. See Remove Center Dash on Page 12-2.
- 3. Disconnect the brown wire at the spade terminal and remove the orange/white wire from the key switch. Do not allow wires to touch.

4. Depress the two retaining tabs (11) and remove the light from the center dash (Figure 12-15, Page 12-19).

Battery Warning Light Installation

 Install in reverse order of removal. Reconnect battery wires (positive cable first) and tighten to 110 in-lb (12.4 N-m). Place Tow/Run switch in the RUN position. Coat terminals with Battery Protector Spray (Club Car Part No. 1014305) to minimize corrosion.

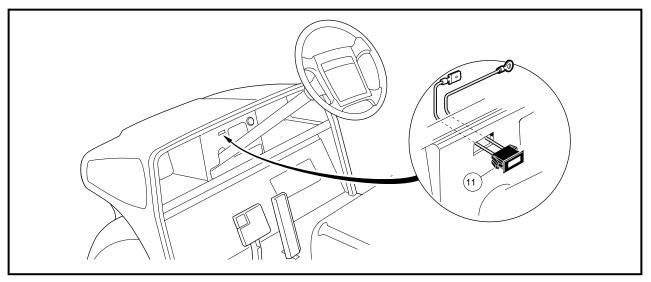


Figure 12-15 Battery Warning Light

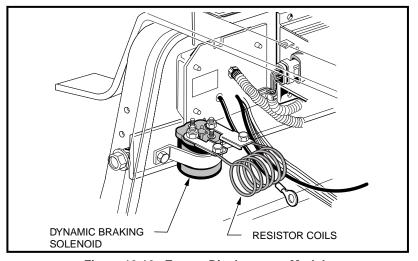


Figure 12-16 Energy Displacement Module

ENERGY DISPLACEMENT MODULE

Read DANGER and WARNING on page 12-1.

Energy Displacement Module Removal

- 1. Place Tow/Run switch in the TOW position and disconnect battery cables (Figure 12-1, Page 12-2).
- 2. Remove the two 1/4 in. nuts, lock washers, flat washers and bolts that secure the coil to the mounting tabs and remove coil (Figure 12-6, Page 12-7).

2 ELECTRICAL COMPONENTS Tow/Run Switch

Energy Displacement Module Installation

1. Installation is reverse of removal. Position the coil ends as shown in **Figure 12-6**, **Page 12-7** and tighten the nuts (6) to 75 in-lb (8.5 N-m). **See also Figure 12-16**, **Page 12-19**. **See following CAUTION**.

A CAUTION

- BE SURE ALL WIRES ARE SECURED IN PLACE SO THEY DO NOT COME INTO CONTACT WITH THE COIL.
- 2. Reconnect battery cables (positive cable first) and tighten to 110 in-lb (12.4 N-m). Place the Tow/Run switch in the RUN position.

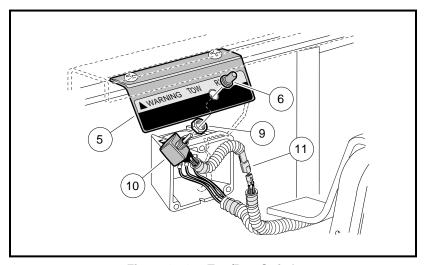


Figure 12-17 Tow/Run Switch

TOW/RUN SWITCH

Read DANGER and WARNING on page 12-1.

Testing the Tow/Run Switch

See Section 11, Test Procedure 6, Page 11-18.

Tow/Run Switch Removal

- 1. Place Tow/Run switch in TOW and disconnect the battery wires as shown (Figure 12-1, Page 12-2).
- 2. Remove Tow/Run switch boot/hex nut (6) (Figure 12-17, Page 12-20).
- 3. Remove nut (9) and Tow/Run switch (10) from bracket (5) (Figure 12-17, Page 12-20).
- 4. Disconnect two-pin connector (11) and remove switch (Figure 12-17, Page 12-20).

Tow/Run Switch Installation

- 1. Installation is reverse of removal. Make sure groove on switch is aligned with tang on bracket. If knurled nut is present, tighten nut (9) to 23 in-lb (2.6 N-m). Tighten Tow/Run switch boot/hex nut (6) to 16 in-lb (1.8 N-m) (Figure 12-17, Page 12-20).
- 2. Reconnect battery wires, positive cable first, and tighten to 110 in-lb (12.4 N-m). Coat terminals with Battery Protector Spray (Club Car Part No. 1014305) to minimize corrosion.
- 3. Place Tow/Run switch in the RUN position.

SECTION 13-BATTERIES

A DANGER

- BATTERY EXPLOSIVE GASES! DO NOT SMOKE. KEEP SPARKS AND FLAMES AWAY. VENTILATE WHEN CHARGING OR USING IN AN ENCLOSED SPACE. ALWAYS WEAR FULL FACE SHIELD AND RUBBER GLOVES WHEN WORKING ON BATTERIES.
- USE EXTREME CAUTION WHEN USING TOOLS, WIRES, OR METAL OBJECTS NEAR BATTERIES! A SHORT CIRCUIT AND (OR) SPARK COULD CAUSE AN EXPLOSION.
- BATTERY POISON! CONTAINS ACID! CAUSES SEVERE BURNS. AVOID CONTACT WITH SKIN, EYES, OR CLOTHING. ANTIDOTES:
 - EXTERNAL: FLUSH WITH WATER. CALL A PHYSICIAN IMMEDIATELY.
 - INTERNAL: DRINK LARGE QUANTITIES OF MILK OR WATER. FOLLOW WITH MILK OF MAGNESIA OR VEGETABLE OIL. CALL A PHYSICIAN IMMEDIATELY.
 - EYES: FLUSH WITH WATER FOR FIFTEEN MINUTES. CALL PHYSICIAN IMMEDIATELY.

A WARNING

- ONLY TRAINED TECHNICIANS SHOULD REPAIR OR SERVICE THIS VEHICLE. ANYONE DOING EVEN SIMPLE REPAIRS OR SERVICE SHOULD HAVE KNOWLEDGE AND EXPERIENCE IN ELECTRICAL AND MECHANICAL REPAIR.
- FOLLOW ALL PROCEDURES EXACTLY AS STATED IN THIS MANUAL, AND HEED ALL DANGER, WARNING AND CAUTION STATEMENTS, AS WELL AS THOSE AFFIXED TO THE VEHICLE.
- WEAR SAFETY GLASSES OR APPROVED EYE PROTECTION WHILE SERVICING VEHICLE. WEAR A FULL FACE SHIELD WHEN WORKING WITH BATTERIES.
- TURN KEY SWITCH **OFF**, PLACE FORWARD/REVERSE HANDLE IN **NEUTRAL**, AND REMOVE KEY PRIOR TO SERVICING.
- DO NOT WEAR LOOSE CLOTHING. REMOVE JEWELRY SUCH AS RINGS, WATCHES, CHAINS, ETC. BEFORE SERVICING VEHICLE.
- USE INSULATED TOOLS WHEN WORKING NEAR BATTERIES OR ELECTRICAL CONNECTIONS. USE EXTREME CAUTION TO AVOID SHORTING OF COMPONENTS OR WIRING.
- TO AVOID UNINTENTIONALLY STARTING THE VEHICLE, DISCONNECT BATTERIES AS SHOWN IN **FIGURE 13-5**, **PAGE 13-4**. DISCHARGE THE CONTROLLER AS FOLLOWS:
 - TURN KEY SWITCH TO **ON** AND PLACE THE FORWARD/REVERSE HANDLE IN THE **REVERSE** POSITION.
 - SLOWLY DEPRESS THE ACCELERATOR PEDAL AND KEEP IT DEPRESSED UNTIL THE REVERSE WARNING BUZZER CAN NO LONGER BE HEARD. WHEN THE BUZZER STOPS SOUNDING, THE CONTROLLER IS DISCHARGED.

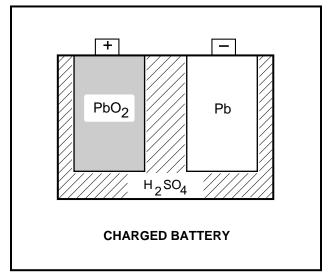
GENERAL INFORMATION

The batteries supplied with a PowerDrive System 48 vehicle are different from those supplied with an automobile. The outward appearance of these two batteries is similar, but the operating characteristics are very different. The PowerDrive System 48 vehicle battery is a deep-cycle battery, and the automotive battery is a "starting, lighting and ignition" (SLI) battery. They should never be substituted for one another.

An automotive battery has to deliver high-cranking currents of 300-400 amperes at a sufficient voltage for several seconds and maintain an accessory load of 10-25 amperes in stop-and-go driving. The energy removed from an automotive battery is immediately replaced by the alternator or generator. As a result, the automotive battery operates at 90 to 100% of full charge at all times.

13 BATTERIES General Information

General Information, Continued:



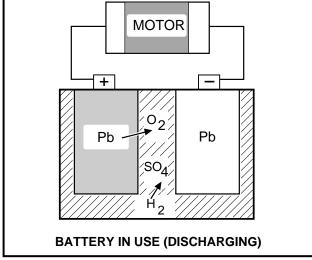
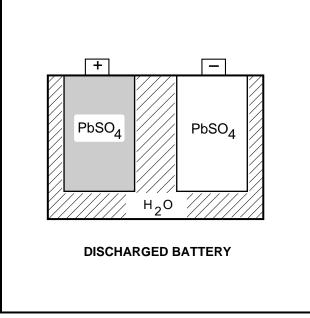


Figure 13-1 Charged Battery

Figure 13-2 Discharging Battery



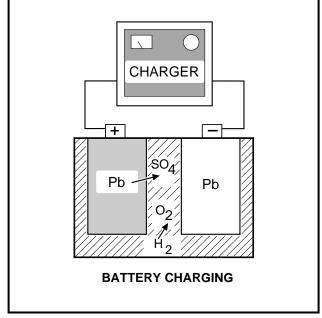


Figure 13-3 Discharged Battery

Figure 13-4 Charging Battery

The batteries supplied with an electric vehicle must supply 100% of the energy required to operate the vehicle. These batteries therefore, receive a deep discharge down to 30% to 40% of their full charge capacity. Then they must be recharged, hence the name "deep cycle." The average amperage draw is considered to be 56 amps on a 48 volt vehicle, although it varies greatly depending on the vehicle and how it is operated. PowerDrive System 48 vehicle batteries are specifically designed to handle this type of service.

The rechargeable lead-acid battery turns chemical energy into electrical energy and vice versa. The main active elements within a battery are the positive plates, the negative plates and the electrolyte (sulfuric acid). Another very important element (but, inactive) is the separator. The separator does exactly what its name implies - it separates the material of the positive and negative plates and prevents them from touching each other, which would create electrical short circuits. The separator is porous enough to allow charged ions to pass between the positive and negative plates, but not allow the two materials to contact each other.

Whenever two unlike metals are immersed in an acid solution, an electric current is generated. In a deep-cycle battery, the negative plates contain lead (Pb) and the positive plates contain lead dioxide (PbO₂). These plates are immersed in a sulfuric acid solution (H_2SO_4) (Figure 13-1, Page 13-2).

During discharge, the chemical reaction inside the battery causes the sulfate (SO_4) to break away from the H_2 (Figure 13-2, Page 13-2).

The sulfate (SO₄) combines with the lead (Pb) on both plates, forming lead sulfate (PbSO₄). Oxygen (O₂) from the positive plates combines with hydrogen (H) from the electrolyte to form water (H₂O) **(Figure 13-3, Page 13-2)**.

The result is two similar metals, lead sulfate (PbSO₄) immersed in water (H₂O). This, will not generate electricity because the battery is completely discharged.

When a discharged battery is connected to a charger, the process is reversed. The sulfate (SO_4) is forced from the plates back into the electrolyte to make sulfuric acid (H_2SO_4) . The oxygen returns to the positive plate to make lead dioxide (PbO_2) (Figure 13-4, Page 13-2).

The result is a charged battery that is again capable of generating electricity (Figure 13-1, Page 13-2).

COMMON MISCONCEPTIONS ABOUT BATTERIES

The chart below describes some of the more common misconceptions that are associated with the Power-Drive System 48 vehicle batteries and battery care.

	PROBLEM	MISCONCEPTION AND REALITY
1.	Deep-Discharge	Misconception- "This vehicle is running slowly, but we can run it until it stops." Reality- This statement is wrong. Avoid deep discharge of batteries whenever possible. See Deep-Discharge, Page 13-7.
2.	Early Excessive Discharging	Misconception- "These are new batteries. They can run all day." Reality- This statement is wrong also. New batteries do not reach their full capacity until they have been used and recharged 20 to 50 times. See Early Excessive Discharging, Page 13-7.
3.	Mineral Content	Misconception- "Tap water will do for our batteries." Reality- Your tap water might be OK, but have it checked first. See Mineral Content, Page 13-6.
4.	Self-Discharge	Misconception- "Dirt and corrosion on the battery won't hurt anything." Reality- Wrong again. Dirt and corrosion might provide a path for current to flow and allow the batteries to self-discharge. See Self-Discharge, Page 13-5.
5.	Overwatering	Misconception- "Batteries can be filled to the level indicator at night, so it won't have to be done in the morning". Reality- Under most circumstances, water should be added <i>after</i> charging. See Electrolyte Level, Page 13-5.
6.	Underwatering	Misconception- "Checking the water takes too much time; it can be checked once a month." Reality- Insufficient watering can ruin batteries. Water level should be checked weekly. See Electrolyte Level, Page 13-5.
7.	Vibration Damage	Misconception- "You should tighten battery hold-downs as tight as you can". Reality- Battery hold-downs should be tightened to specification. Hold-downs that are too tight or too loose can cause battery damage. See Vibration Damage, Page 13-6.

BATTERIES Replacing Batteries

REPLACING BATTERIES

WARNING

- TO PREVENT ELECTROLYTE LEAKAGE FROM THE BATTERY VENTS, BATTERIES MUST BE KEPT IN AN UPRIGHT POSITION. TIPPING A BATTERY BEYOND A 45° ANGLE IN ANY DIRECTION CAN ALLOW A SMALL AMOUNT OF ELECTROLYTE TO LEAK OUT THE VENT HOLE. DO NOT EXCEED THIS 45° ANGLE WHEN LIFTING, CARRYING, OR INSTALLING BATTERIES. BATTERY ACID CAN CAUSE SEVERE PERSONAL INJURY TO SKIN OR EYES, AND CAN DAMAGE CLOTHING.
- Before removing batteries, note the orientation of the batteries and the connecting wires. Disconnect
 the batteries and discharge the controller as described in the WARNING on page 13-1. Then remove
 remaining wires and batteries. See Figure 13-5, Page 13-4 for PowerDrive System 48 vehicle battery wiring.
- 2. Visually inspect the new batteries for any damage that may have occurred in transit.
- 3. If old battery cables are to be reused, inspect them for broken or frayed wires, damaged terminals, or worn insulation. Remove any corrosion on the connectors. One cup of bicarbonate of soda (baking soda) in a gallon of water and a bristle brush do an excellent job of neutralizing and removing the corrosion. Be careful not to allow the baking soda solution to enter the battery.

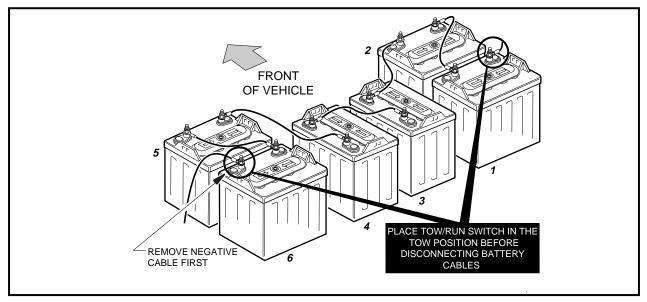


Figure 13-5 PowerDrive Battery Configuration

- 4. Check and clean the battery rack and hold-downs. The nuts and bolts on the hold-downs may corrode. It is therefore advised they be cleaned periodically and replaced as necessary.
- 5. Install batteries in the proper orientation (Figure 13-5, Page 13-4). Install battery hold-downs. The hold-downs should be tight enough so batteries do not move while vehicle is in motion, but not so tight as to crack or buckle battery case. Tighten to 40 in-lb (4.5 N-m), alternating between hold-down bolts.
- 6. Install wires in proper sequence (Figure 13-5, Page 13-4). Install black wire to negative post of battery No. 6 last. Make sure all connections are tight. Tighten to 110 in-lb (12.4 N-m). Coat all terminals with Battery Protector Spray (Club Car Part No.1014305) to minimize future corrosion.
- 7. Give the batteries a full charge prior to operation. This ensures all the batteries are fully charged and the cells are equalized prior to use.

Battery Care

BATTERY CARE

Read DANGER and WARNING on page 13-1.

PREVENTIVE MAINTENANCE

To keep batteries in sound operating condition, follow these steps on a regular basis.

- Any corrosion build-up on or around batteries should be removed immediately. Terminal connections should be clean and tight. Any frayed or worn wires should be replaced. After all cables have been connected, coat all terminals with Battery Protector Spray (Club Car Part No.1014305) to help prevent future corrosion.
- 2. Batteries should be kept clean and dry to prevent self-discharge. Any dirt, grime or acid spillage should be removed. Wash batteries with a bristle brush using water and bicarbonate of soda (baking soda - 1 cup per gallon of water). Rinse with water. Do not allow solution to enter battery through the vent cap holes. See Self-Discharge below.
- 3. Maintain proper electrolyte level. See Electrolyte Level below.
- 4. Batteries should be properly charged every day they are used. Check the batteries periodically to see that they are in a full state of charge. See Battery Charging, Page 13-6.
- 5. Keep hold-downs tight. See Vibration Damage, Page 13-6.

SELF-DISCHARGE

Dirty batteries can provide a path for a small current draw that can slowly discharge batteries, thus wasting valuable energy. To prevent self-discharge, batteries should always be kept clean.

Hot weather also has an effect on a battery's self-discharge rate. The higher the temperature, the quicker a set of batteries will discharge. In hotter climates, batteries should be checked more often. When storing batteries, keep in a cool place. See Battery Storage, Page 13-13.

ELECTROLYTE LEVEL

A CAUTION

 DO NOT ALLOW BATTERY ACID FROM BATTERY CAPS OR HYDROMETER TO DRIP ONTO THE FRONT OR REAR BODY OF THE VEHICLE. BATTERY ACID WILL CAUSE PERMANENT DAMAGE. WASH IMMEDIATELY.

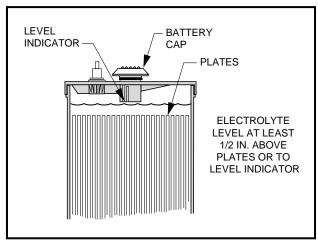


Figure 13-6 Battery Electrolyte Level

BATTERIES Battery Charging

Electrolyte Level, Continued:

Add water only after charging unless the electrolyte is below the level of the plates. If the electrolyte level is below the level of the plates, add just enough water to cover the plates and then charge the batteries. After charging, fill with water to the level indicator. Filling a battery to the level indicator before charging will result in overfilling because the electrolyte level will rise during charging and some of the electrolyte may bubble out of the cap. This reduces the battery's capacity and corrodes the metal parts around it.

The electrolyte level should be checked weekly to be sure electrolyte is at its proper level (Figure 13-6, Page 13-5). Never allow the electrolyte level to fall below the tops of the plates because this will cause the exposed part of the plate to become permanently inactive. For best results, use a battery watering gun to add water to batteries. Check the electrolyte level more frequently in hot weather or when batteries are old.

MINERAL CONTENT

For the longest battery life, use distilled water in batteries. However, if tap water is to be used, be sure the mineral contents are below these levels:

IMPURITY	ALLOWABLE CONTENT IN PARTS PER MILLION
Suspended Matter	Trace
Total Solids	100.00
Calcium and Magnesium Oxides	40.0
Iron	5.0
Ammonia	8.0
Organic Matter	50.0
Nitrates	10.0
Nitrites	5.0
Chloride	5.0
Contact your local water department for this analysis.	

VIBRATION DAMAGE

The battery hold-downs should always be tight enough to keep the battery from bouncing. Battery life may be severely shortened if the battery hold-downs are too loose. Battery hold-downs should be tightened to 40 in-lb (4.5 N-m). Excessive vibration causes the plates to shed prematurely and shortens the life of the battery. It may also cause acid to leak out of the vent caps and corrosion to build up on surrounding metal parts. The acid which is lost reduces the capacity of the battery and cannot be replaced. Battery hold-downs should NOT be so tight as to crack or buckle the battery case. This may cause leaks which would dry out a cell or cause internal short circuits. **See Replacing Batteries, Page 13-4**.

BATTERY CHARGING

Read DANGER and WARNING on page 13-1.

The charger supplied with the PowerDrive System 48 electric vehicle resolves the most common problems associated with battery charging. Undercharging and overcharging are prevented provided the charger is allowed to shut off by itself. Also, all cells are automatically given an equalization charge at low current, which prolongs battery life. Batteries should never be left in a discharged state, as this too affects the internal components and can reduce the capacity of the battery. The batteries should be charged every day they are used. However, the batteries should not be charged if they have not been used.

CHARGER SHUTS OFF AFTER 16 HOURS

This may be due to,1) new batteries, 2) hard use or 3) cold temperatures. A catch-up charge may be necessary when these conditions are present. On those days when all or some of the vehicles do not get used, check the batteries for state of charge. Any battery with a specific gravity lower than 1.250 will need a catchup charge. If the problem continues after a catch-up charge has been performed, refer to Section 14-PowerDrive Battery Charger.

DEEP-DISCHARGE

Never discharge batteries to the point the vehicle will no longer operate. This will considerably shorten the cycle life of the batteries, and may permanently damage the batteries. It is possible the batteries will not accept a recharge if they are completely discharged. The deeper the discharge, the harder it is on the batteries. For this reason, it is recommended that PowerDrive System 48 vehicle batteries be charged after each use (provided the charge cycle will not be interrupted and the charger will be allowed to shut off automatically). Placing the batteries on charge after each use reduces the depth of discharge and prolongs battery life.

EARLY EXCESSIVE DISCHARGING

When vehicle batteries are new, they do not reach their full capacity until they have been used and recharged 20 to 50 times. If they are excessively discharged early in their life, their effective service life will be shortened. It is advisable to limit the use of any vehicle with new batteries for at least the first four weeks and then gradually increase their range.

INCOMING AC SERVICE

Make sure the incoming AC line service is sufficient. If circuit breakers are tripping, fuses blow during the night or the charger does not give the required starting rate when sound batteries are put on charge, an AC line problem exists. The electrical service to the vehicle storage facility should be sufficient to deliver adequate voltage and current to each charger with all the chargers turned on. If not, consult your local power company or electrical contractor. See Section 14-PowerDrive Battery Charger.

FLEET ROTATION

Rotate vehicle usage. It is very hard on batteries if the last vehicles in at night are the first ones out in the morning. Spread the workload evenly, giving all vehicles the same amount of use. This will keep your fleet in balance and will not overwork certain sets of batteries.

NOTE

• WHEN VEHICLES ARE BEING ROTATED, THE CLUB CAR CDM (COMMUNICATION DISPLAY MODULE) CAN BE A VERY HELPFUL SERVICE TOOL. MONITORING THE VALUE OF FUNCTION 3 WITH THE CDM SIMPLIFIES VEHICLE USAGE SCHEDULING. SEE SECTION 11, PAGE 11-26.

NUMBERING VEHICLES AND CHARGERS

Return the vehicles to the same charger each night if possible. If the vehicles are put in a storage facility at random and a vehicle dies while in use and testing shows the batteries are sound, then the problem is most likely with the charger. However, finding the problem charger may prove to be quite time consuming. Numbering the vehicles and the chargers and returning each vehicle to its designated charger each night can significantly reduce the amount of time spent troubleshooting a problem.

BATTERY TESTING

Read DANGER and WARNING on page 13-1.

Battery Testing, Continued:

Four tests have been developed to help diagnose problems with batteries that have not performed as expected. Because each test becomes progressively more detailed and time-consuming, begin with the first test and follow through with the other tests until the problem has been identified as outlined in the Battery Troubleshooting Chart (Figure 13-7, Page 13-9).

BATTERY CHARGER TEST

The easiest way to monitor the condition of a vehicle's batteries is simply to observe the reading on the battery charger ammeter at the end of the charge cycle. After a full charge, disconnect the charger DC plug, wait 20 to 30 seconds and reconnect the charger DC plug. The ammeter needle will jump to 15 amps or more and then taper to below 6 amps within 10 to 20 minutes, indicating sound, fully charged batteries.

Continued poor performance may indicate a problem in the vehicle electrical system, brakes or battery charger. If the problem is not found in the vehicle or charging system, proceed to the on-charge voltage test. Batteries that remain at 8 amps or higher should be tested further using the on-charge voltage test.

ON-CHARGE VOLTAGE TEST

When the batteries are fully charged, disconnect the charger DC plug. Wait 20 to 30 seconds and reconnect the DC plug to restart the charger. After 5 minutes, use a multimeter to check and record the voltage of the battery set as well as the individual batteries. Set the meter to 200 volts DC. Place the red (+) probe at the positive post of battery No. 1 and the black (–) probe at the negative post of battery No. 6 (Figure 13-5, Page 13-4). Record reading. Then set multimeter to 20 volts DC and place the red (+) probe at the positive terminal and the black (–) probe at the negative terminal of each battery. Record the readings.

The on-charge voltage for the set should be between 56.0 volts and 63.0 volts depending on the age and state of charge of the batteries being tested. If individual batteries read above 9.3 volts and are within 0.7 volts of each other, go to hydrometer test. If any battery reads below 9.3 volts and not within 0.7 volts of those batteries above 9.3 volts, replace battery. If readings are below 9.3 volts but within 0.7 volts of each other, the batteries are old. Old batteries may have enough capacity left to last several more months. Go to hydrometer test. **See Troubleshooting Chart, Figure 13-7, Page 13-9, and examples on following pages**.

HYDROMETER TEST

A hydrometer measures the specific gravity of the battery's electrolyte. The higher the specific gravity, the higher the state of charge of the batteries. A fully charged battery should read between 1.250 and 1.280 at 80°F (26.7°C). Never add acid to batteries to obtain a higher specific gravity.

Performing the Hydrometer Test

- 1. Be sure batteries have sufficient electrolyte to cover plates by approximately 1/2 inch and are fully charged prior to beginning test. If water must be added, recharge the batteries before performing the hydrometer test.
- 2. Remove the vent cap. Using a battery thermometer (Club Car part No.1011767), record electrolyte temperature of the No. 2 cell.
- 3. Squeeze the rubber bulb of the hydrometer and insert into the cell. Slowly release the bulb, drawing electrolyte up into the glass tube of the hydrometer.
- 4. When the float rises off the bottom, adjust the electrolyte level so that the float rides free of the bottom but does not strike the top of the glass tube. Remove the hydrometer from the cell and release the pressure from the bulb.
- 5. Hold the hydrometer vertically, ensuring the float is not touching the sides of the barrel. Hold the hydrometer at eye level and read the scale at the level of electrolyte (Figure 13-8, Page 13-10).
- 6. Record the reading and return the electrolyte to the cell from which it was taken. Replace vent cap.
- 7. Repeat steps 2 through 6 on all cells.

BATTERY TROUBLESHOOTING CHART

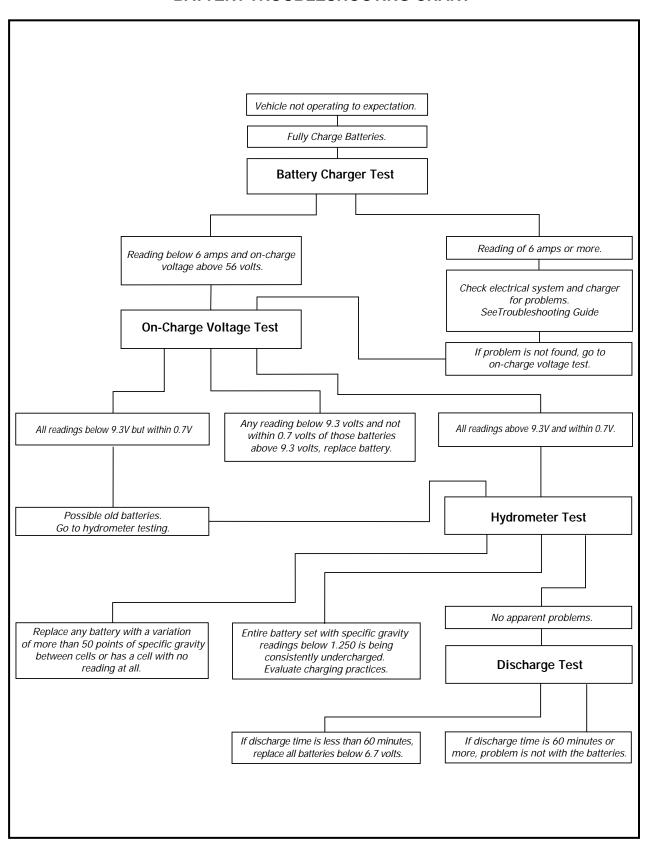


Figure 13-7 Troubleshooting Chart

Hydrometer Calibration

Most hydrometers are calibrated to read correctly at 80°F (26.7°C). The readings obtained as described above must be corrected for temperature. For each 10°F (5.6°C) above 80°F (26.7°C), add .004 to the reading. For each 10°F (5.6°C) below 80°F (26.7°C), subtract .004 from the reading.

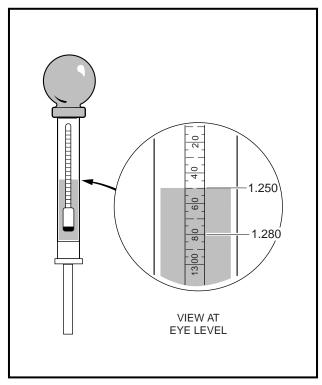


Figure 13-8 Hydrometer

Interpreting the Results of the Hydrometer Test

The approximate state of charge can be determined from the following table:

SPECIFIC GRAVITY AT 80°F (26.7°C)	STATE OF CHARGE
1.250 - 1.280	100%
1.220 - 1.240	75%
1.190 - 1.210	50%
1.160 - 1.180	25%

If the difference between the cells is .020 or more, the low cell should be suspected. It may require a catchup charge or it may be a weak cell. When the variations between cells reach .050 or more, the battery with the low cell should be replaced.

VEHICLE NO.	BATTERY	ELECTROLYTE	CORRECTION		CORRECTED SF	PECIFIC GRAVITY		REQUIRED
	NO.	TEMP.	FACTOR	CELL 1	CELL 2	CELL 3	CELL 4	ACTION
12	1	20°F (-6.6°C)	024	1.275024=1.251	1.280024=1.256	1.280024=1.256	1.280024=1.256	Sound Battery- Fully Charged
35	6	90°F (32.2°C)	+.004	1.155+.004=1.159	1.165+.004=1.169	1.160+.004=1.164	1.165=.004=1.169	Discharged Battery- Recharge
54	3	50°F (10°C)	012	1.260012=1.248	1.200012=1.188	1.270012=1.258	1.270012=1.258	Bad No. 2 Cell

VEHICLE NO.	BATTERY	ELECTROLYTE	CORRECTION		CORRECTED SP	PECIFIC GRAVITY		REQUIRED
	NO.	TEMP.	FACTOR	CELL 1	CELL 2	CELL 3	CELL 4	ACTION
69	5	80°F (26.7°C)	.000	1.250-0=1.250	1.255-0=1.255	1.230-0=1.230	1.250-0=1.250	Weak No. 3 Cell- Catch-up Charge
38	2	100°F (37.8°C)	+.008	1.200+.008=1.208	1.180+.008=1.188	1.170+.008=1.178	1.180+.008=1.188	Discharged Battery- Recharge and Recheck
22	4	80°F (26.7°C)	.000	1.240-0=1.240	1.245-0=1.245	Float Does Not Rise	1.250-0=1.250	No.3 Cell Dead- Replace Battery

DISCHARGE TEST

If the previous tests have failed to identify the problem, conduct a discharge test. The discharge test comes closest to simulating actual vehicle operating conditions by continuously drawing 56 amps from the batteries until voltage drops to 42.0 volts.

The discharge test is the hardest test on the batteries and the most time-consuming to perform. Use the battery discharge tester (Club Car Part No.101831901).

Performing the Discharge Test

- 1. Be sure the batteries are fully charged and that the electrolyte level is correct in all cells.
- 2. Connect the tester leads to the positive (+) post of battery No.1 and negative (-) post of battery No. 6 (Figure 13-9, Page 13-11).

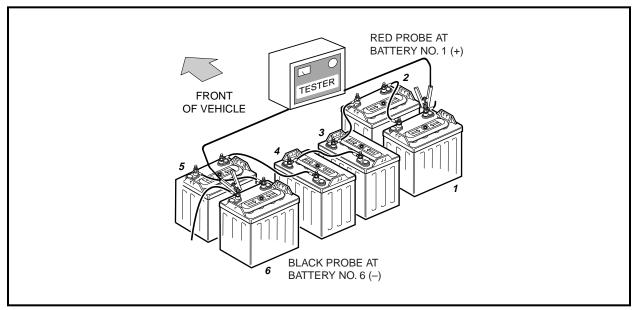


Figure 13-9 Battery Discharge Test

- 3. Check and record the electrolyte temperature of the battery packs. Check cell No. 2 (second cell from positive post) in each battery.
- 4. Reset discharge machine and turn the tester ON.
- 5. When the batteries have been discharging for approximately 60 minutes, set the discharge machine to function 3 and check battery set voltage. Check voltage every 10 minutes throughout the rest of the test. As soon as the battery set voltage reaches .5 volts above the shut-off point (42.0 volts), use a multimeter to measure individual battery voltages. Measure and record the voltage of each battery to the nearest .01 volt.

NOTE

• THE TESTER WILL SHUT OFF AUTOMATICALLY WHEN SHUT-OFF VOLTAGE IS REACHED.

Interpreting Discharge Test Results

- 1. If discharge time is 60 minutes or higher, the problem is not with the batteries.
- 2. If discharge times are low (less than 60 minutes), replace batteries below 6.7 volts.

BATTERY VOLTAGES						
1	2	3	4	5	6	BATTERY CONDITION
7.00	7.00	7.00	7.00	7.00	7.00	EXCELLENT
7.07	7.07	7.22	6.50	7.07	7.07	BATTERY NO. 4 IS NEAR END OF USEFUL LIFE
7.20	7.20	6.67	7.33	6.27	7.33	BATTERY NOS. 3 AND 5 ARE NEAR END OF USEFUL LIFE

3. In general, vehicles that discharge in less than 60 minutes at 78°F (25.6°C) on the discharge test will typically not hold a charge for an entire work shift. However, discharge time is dependent on the electrolyte temperature. The table shown gives the discharge times, at various temperatures, of a set of batteries that delivers 62 minutes at 80°F (26.7°C).

ELECTROLYTE TEMP. °F (°C)	DISCHARGE TIME TO SHUT-OFF POINT	ELECTROLYTE TEMP. °F (°C)	DISCHARGE TIME TO SHUT-OFF POINT
40 - 49 (4.4 - 9.4)	40 Minutes	85 - 89 (29.4 - 31.7)	64 Minutes
50 - 59 (10 - 15)	45 Minutes	89 - 99 (31.7 - 37.2)	66 Minutes
60 - 64 (15.6 - 17.8)	50 Minutes	100 - 109 (37.8 - 42.8)	68 Minutes
65 - 69 (18.3 - 20.6)	54 Minutes	110 - 119 (43.3 - 48.3)	70 Minutes
70 - 74 (21.1 - 23.3)	57 Minutes	120 - 129 (48.9 - 53.9)	72 Minutes
75 - 79 (23.9 - 26.1)	60 Minutes	130 - 150 (54.4 - 65.6)	74 Minutes
80 - 84 (26.7 - 28.9)	62 Minutes	****	****

BATTERY TROUBLESHOOTING EXAMPLES

The following information represents a few examples of troubleshooting battery problems.

Example 1

Vehicle No. 68 was suspected of having a bad battery due to its performance. As a result, the battery charger test was performed. After a full charge, the battery charger ammeter read 8.0 amps. Next, the on-charge voltage test was performed and the following results were recorded:

BATTERY NO.	1	2	3	4	5	6
ON-CHARGE VOLTAGE	10.15	10.60	9.80*	10.16	10.56	10.61

^{*}Battery No. 3 appears suspect. Battery Nos. 1 and 4 are also suspect. Next, a hydrometer test should be conducted on all batteries.

Hydrometer test results:

BATTERY NO.	1	2	3	4	5	6
	SPECIFIC GRAVITY					
CELL 1 (POSITIVE POST)	1.200*	1.265	1.300	1.250	1.280	1.260
CELL 2	1.285	1.275	1.290	1.270	1.295	1.265
CELL 3	1.265	1.270	1.275	1.265	1.280	1.275
CELL 4 (NEGATIVE POST)	1.275	1.270	1.285	1.265	1.275	1.275

^{*}After the hydrometer test, it appears that battery No. 1 is the problem. Next, the discharge test was performed.

Discharge test results:

BATTERY NO.	1	2	3	4	5	6
DISCHARGE VOLTAGE	5.44*	7.33	7.73	7.15	7.43	7.41

^{*}After a discharge test which lasted 45 minutes, battery No. 1 is clearly shown to be the problem. Battery No. 4 should be watched a little more closely but appears to be okay. Battery No. 1 should be replaced with a battery that has about the same age and usage as the other batteries in the set.

Example 2

Vehicle No. 70 was also suspected of having a bad battery due to its performance. The battery charger test showed 7.0 amps after a full charge. After confirming there were no problems with the electrical system, charger or brakes, the on-charge voltage was recorded as follows:

BATTERY NO.	1	2	3	4	5	6
ON-CHARGE VOLTAGE	10.48	9.77*	10.53	10.57	10.55	10.33

^{*}Battery No. 2 was immediately suspected as the problem. After checking battery No. 2 with a hydrometer, it was discovered that the negative post cell was completely dead. Battery No. 2 should be replaced with a battery that has the same age and usage as the other batteries in the set.

BATTERY STORAGE

Read DANGER and WARNING on page 13-1.

When storing batteries during the off-season or when maintaining a replacement stock, follow these guidelines:

- 1. Keep the batteries clean and free of corrosion as outlined in Battery Care, page 13-5.
- 2. Batteries that are in vehicles for winter storage should be left disconnected in the vehicles if the batteries are not going to be connected to a charger.
- 3. Fully charge the batteries prior to storage.
- 4. Store in a cool area. The colder the area in which the batteries are stored, the less the batteries will self-discharge. Batteries stored at 0°F (-17.8°C) will discharge very little over a four-month period. Batteries stored at 80°F (26.7°C) will have to be recharged every few weeks.
- 5. Vehicles with PowerDrive System 48 and PowerDrive Chargers are designed to be left connected, with AC power to the charger ON, during off-season storage. The PowerDrive storage charge feature will automatically charge the batteries as needed throughout the storage period.

CHARGING A BATTERY PACK THAT HAS LOW VOLTAGE

See Section 14-PowerDrive Battery Charger.

SECTION 14-POWERDRIVE BATTERY CHARGER

A DANGER

- BATTERY EXPLOSIVE GASES! DO NOT SMOKE. KEEP SPARKS AND FLAMES AWAY. VENTILATE WHEN CHARGING OR USING IN AN ENCLOSED SPACE. ALWAYS WEAR FULL FACE SHIELD AND RUBBER GLOVES WHEN WORKING ON OR NEAR BATTERIES.
- USE EXTREME CAUTION WHEN USING TOOLS, WIRES, OR METAL OBJECTS NEAR BATTERIES! A SHORT CIRCUIT AND (OR) SPARK COULD CAUSE AN EXPLOSION.
- BATTERY POISON! CONTAINS ACID! CAUSES SEVERE BURNS. AVOID CONTACT WITH SKIN, EYES, OR CLOTHING. ANTIDOTES:
 - EXTERNAL: FLUSH WITH WATER. CALL A PHYSICIAN IMMEDIATELY.
 - INTERNAL: DRINK LARGE QUANTITIES OF MILK OR WATER. FOLLOW WITH MILK OF MAGNESIA OR VEGETABLE OIL. CALL A PHYSICIAN IMMEDIATELY.
 - EYES: FLUSH WITH WATER FOR FIFTEEN MINUTES. CALL PHYSICIAN IMMEDIATELY.

A WARNING

- ONLY TRAINED TECHNICIANS SHOULD REPAIR OR SERVICE THIS VEHICLE. ANYONE DOING EVEN SIMPLE REPAIRS OR SERVICE SHOULD HAVE KNOWLEDGE AND EXPERIENCE IN ELECTRICAL AND MECHANICAL REPAIR.
- FOLLOW ALL PROCEDURES EXACTLY AS STATED IN THIS MANUAL, AND HEED ALL DANGER, WARNING AND CAUTION STATEMENTS, AS WELL AS THOSE AFFIXED TO THE VEHICLE.
- WEAR SAFETY GLASSES OR APPROVED EYE PROTECTION WHILE SERVICING VEHICLE.
- TURN KEY SWITCH **OFF**, PLACE FORWARD/REVERSE ROCKER SWITCH IN **NEUTRAL**, AND REMOVE KEY PRIOR TO SERVICING.
- DO NOT WEAR LOOSE CLOTHING. REMOVE JEWELRY SUCH AS RINGS, WATCHES, CHAINS, ETC. BEFORE SERVICING VEHICLE.
- USE INSULATED TOOLS WHEN WORKING NEAR BATTERIES OR ELECTRICAL CONNECTIONS. USE EXTREME CAUTION TO AVOID SHORTING OF COMPONENTS OR WIRING.
- DISCONNECT THE ELECTRICAL CORDS BEFORE ATTEMPTING ANY REPAIR TO THE CHARGER.
 FIRST DISCONNECT THE AC CORD FROM THE OUTLET AND THEN DISCONNECT THE DC CORD FROM THE VEHICLE.
- BEFORE PERFORMING TESTS OR REPAIRS AND TO AVOID UNINTENTIONALLY STARTING THE VEHICLE, MAKE SURE CAPACITORS ARE DISCHARGED. PLACE TOW SWITCH IN TOW, DISCONNECT BATTERY WIRES AS SHOWN IN FIGURE 14-3, PAGE 14-6, PLACE FORWARD/ REVERSE ROCKER SWITCH IN REVERSE AND LISTEN FOR THE REVERSE BUZZER:
 - IF THE BUZZER DOES NOT SOUND, THE CAPACITORS ARE DISCHARGED.
 - IF THE REVERSE BUZZER SOUNDS, TURN THE KEY SWITCH **ON** AND DEPRESS THE ACCELERATOR PEDAL UNTIL THE BUZZER CAN NO LONGER BE HEARD.

GENERAL INFORMATION

The PowerDrive Battery Charger is an integral part of the PowerDrive Plus electrical system, and one is included with every PowerDrive Plus vehicle. Because it is controlled by the PowerDrive onboard computer (OBC) it can be used with PowerDrive Plus or PowerDrive System 48 vehicles only. The charger is automatic and has no external

General Information, Continued:

controls; when it is plugged into the vehicle receptacle, there is a 2 to 15 second delay before charging begins (Figure 14-1, Page 14-2). The OBC records the amount of energy consumed as the vehicle is used, then directs the charger to replace exactly the amount of energy needed to fully replenish the batteries. The charger then shuts off automatically, preventing the possibility of either undercharging or overcharging. The computer accomplishes this by detecting when the exact amount of energy required has been returned to the batteries.

NOTE

• SHORTLY AFTER CHARGING BEGINS, THE CHARGER WILL SHUT OFF IN ORDER TO RUN A SELF-DIAGNOSTIC PROGRAM (AMMETER WILL DROP TO ZERO). CHARGING WILL RESUME IN A FEW MOMENTS (AMMETER RETURNS TO PREVIOUS RATE OF CHARGE). THIS WILL BE REPEATED AT ONE HOUR AND AT TWO HOURS INTO THE CHARGE CYCLE.

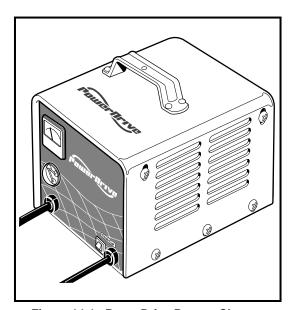


Figure 14-1 PowerDrive Battery Charger

POWERDRIVE CHARGING FEATURES

Charge Interlock

PowerDrive Battery Charger DC plugs have three pins rather than two blades that most standard charger plugs have. Two of these pins are the positive and negative leads as on standard chargers; the third pin is a sensing lead which is the communication link between the charger and the onboard computer. When the charger plug is inserted into the vehicle receptacle, the onboard computer locks out the vehicle's drive system. This prevents the possibility of driving the vehicle while the charger is plugged in and potentially damaging the vehicle and charger.

Long Term Storage Charge

PowerDrive Plus vehicles and PowerDrive Chargers are designed to be left connected, with AC power to the charger, during off-season or long-term storage. The onboard computer will automatically activate the charger every 15 days. To return the vehicle to service, disconnect the DC cord from the vehicle, wait 15 seconds and then plug the DC cord back in. The charger will activate. Allow the vehicle to complete one full charge cycle before putting it into service.

Charger Disconnect

The computer communication pin is shorter than the positive and negative pins in the charger DC plug. In the event the charger plug is pulled from the receptacle while the charger is in operation, the computer communication link will be disconnected first, which will shut the charger off before the positive and negative pins disconnect. This will help prevent possible damage to the plug and receptacle due to arcing.

BATTERY WARNING LIGHT

The PowerDrive vehicle features a dash-mounted battery warning light (above steering column) which, when the vehicle is in operation, indicates low battery voltage, or, when the vehicle is being charged, indicates a charging problem. The battery warning light is controlled by the PowerDrive Plus onboard computer.

When the batteries receive an incomplete charge because 1) the DC power cord is disconnected, 2) AC power to the charger is interrupted, 3) automatic charger shut-off occurs after 16 hours of operation, or 4) the charger malfunctions, the warning light will indicate as follows:

- The warning light will not illuminate if the charge is 90% or more complete. The onboard computer will
 retain in memory the amount of charge needed to fully replenish the batteries and will complete the
 charge during the next charge cycle.
- When the charger DC cord is unplugged, the warning light will illuminate and remain illuminated for 10 seconds if the charge is less than 90% complete but the vehicle has enough power for 60 minutes of operation. This will alert the fleet operator that the vehicle may be used, but that it must be charged to completion as soon as possible.
- The warning light will repeatedly illuminate for 10 seconds, at 4 second intervals, if the charger times out at 16 hours and the batteries are not sufficiently charged. This indicates an abnormal charge cycle. The charger and batteries should be checked by your Club Car distributor/dealer.
- The warning light will repeatedly illuminate for 10 seconds, at 4 second intervals, during a charge cycle (DC plug is still connected) if AC power to the charger is interrupted. The warning light will go out when AC power is restored.

THE CHARGE CIRCUIT

The vehicle charge circuit consists of the charger receptacle, fuse link, onboard computer and the batteries. The negative terminal of the receptacle is connected to the onboard computer. The 10 gauge black wire from the onboard computer connects to the B— terminal on the speed controller, and the 6 gauge black wire (also on the controller B— terminal) goes through the onboard computer and connects to the negative (—) post of battery No. 6. The positive terminal of the charger receptacle is connected to the positive post of battery No. 1. The gray wire (sense lead) from the charger receptacle is connected to the sense lead fuse, which is connected to the gray wire from the onboard computer.

If the charger works with one vehicle, but does not work with another, then most likely the problem is in the vehicle charge circuit. Check the connections between the 18 gauge gray wire from the charger receptacle, the sense lead fuse and the 18 gauge gray wire from the onboard computer. Also check connections of the fuse link assembly located on the charger receptacle (Figure 14-2, Page 14-5).

CHARGER INSTALLATION AND USE

Read DANGER and WARNING on page14-1.

A WARNING

- DO NOT BYPASS THE SENSE LEAD FUSE!
- DISCONNECT BOTH THE AC AND DC PLUGS BEFORE WORKING ON THE CHARGER OR CHANGING THE CHARGER CORD.

WARNING CONTINUED ON FOLLOWING PAGE...

A WARNING

- TO CONNECT THE CHARGER PLUG TO THE VEHICLE RECEPTACLE, GRASP THE PLUG AND PUSH IT STRAIGHT INTO THE RECEPTACLE. DO NOT ROCK OR BEND THE PLUG.
- TO DISCONNECT THE CHARGER FROM THE VEHICLE RECEPTACLE, GRASP THE PLUG AND PULL IT STRAIGHT OUT OF THE RECEPTACLE. DO NOT PULL ON THE CORD. DO NOT TWIST, ROCK, OR BEND THE PLUG.
- DO NOT CONNECT THE CHARGER TO BATTERY PACKS THAT ARE NOT COMPATIBLE WITH THE DC OUTPUT VOLTAGE SPECIFIED ON THE CHARGER. OVERHEATING AND TRANSFORMER BURN-OUT WILL RESULT.
- DO NOT USE THE CHARGER IF THE PLUG, CORD, OR RECEPTACLE HAVE BEEN DAMAGED IN ANY WAY. USE OF THE CHARGER WITH ANY OF THESE CONDITIONS COULD RESULT IN A FIRE, PROPERTY DAMAGE, PERSONAL INJURY, OR DEATH.
- DO NOT USE THE CHARGER IF:
 - THE DC PLUG DOES NOT MAKE A GOOD CONNECTION.
 - THE PLUG AND RECEPTACLE FEEL HOTTER THAN NORMAL.
 - THE PLUG PINS OR RECEPTACLE CONTACTS ARE BENT OR CORRODED.
 - THE PLUG, RECEPTACLE, OR CORDS ARE CUT, WORN, OR HAVE ANY EXPOSED WIRES.
 - THE PLUG, CORDS, CHARGER, OR RECEPTACLE ARE DAMAGED.
- USING THIS CHARGER WITH ANY OF THE ABOVE CONDITIONS COULD RESULT IN FIRE, PERSONAL INJURY, OR PROPERTY DAMAGE. REPAIR OR REPLACE WORN OR DAMAGED PARTS BEFORE USING THE CHARGER.
- EACH CHARGER SHOULD HAVE ITS OWN 15 OR 20 AMPERE BRANCH CIRCUIT PROTECTION (CIRCUIT BREAKER OR FUSE), IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE ANSI/NFPA 70, AND LOCAL CODES AND ORDINANCES. IMPROPER AC SUPPLY CIRCUIT PROTECTION MAY RESULT IN A FIRE.

Each PowerDrive Plus electric vehicle is supplied with a fully automatic, external battery charger as standard equipment.

To reduce the risk of electric shock, the battery charger must be grounded. The charger is equipped with an AC electric cord with an equipment-grounding conductor and a grounding type plug. It is for use on a nominal 120-volt, 60-hertz single-phase circuit. The AC plug must be connected to an appropriate receptacle that is properly installed and grounded in accordance with the National Electric Code and all local codes and ordinances.

The use of an extension cord with the charger is not recommended. If an extension cord must be used, use a three-conductor No. 12 AWG cord with ground, properly wired and in good electrical condition. Keep it as short as possible (no more than twelve feet). Place all cords so they will not be stepped on, tripped over, or otherwise subject to damage or stress. **See following WARNING**.

Provide adequate ventilation for the charger. Keep all charger ventilation openings at least two inches away from walls and other objects. **See following WARNING.**

A WARNING

- IMPROPER CONNECTION OF THE EQUIPMENT-GROUNDING CONDUCTOR CAN RESULT IN AN ELECTRICAL SHOCK.
- DO NOT USE AN ADAPTER TO PLUG CHARGER INTO A TWO-BLADE OUTLET OR EXTENSION CORD. EXTENSION CORD OR OUTLET MUST ACCEPT GROUNDED THREE-BLADE PLUG.

WARNING CONTINUED ON FOLLOWING PAGE...

A WARNING

- THE USE OF AN IMPROPER EXTENSION CORD COULD RESULT IN FIRE OR ELECTRIC SHOCK.
- DO NOT OPERATE THIS CHARGER IF IT HAS RECEIVED A SHARP BLOW, WAS DROPPED, OR WAS OTHERWISE DAMAGED. MAKE SURE IT IS OPERATING PROPERLY BEFORE PUTTING IT BACK IN USE.
- DO NOT ALLOW CLOTHING, BLANKETS, OR OTHER MATERIALS TO COVER THE CHARGER.
- CHARGERS CAN IGNITE FLAMMABLE MATERIALS AND VAPORS. DO NOT USE NEAR FUELS, GRAIN DUST, SOLVENTS, THINNER, OR OTHER FLAMMABLES.
- KEEP CHARGER DRY DO NOT EXPOSE TO RAIN. STORE INDOORS.

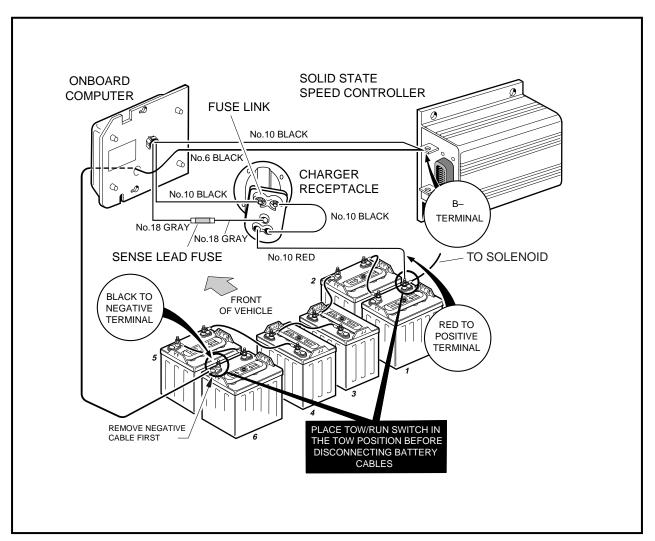


Figure 14-2 Charge Circuit

Normal Charger Operation

- 1. With the charger DC output cord disconnected from the batteries, connect the power supply cord to a 120-volt, 60-hertz single-phase outlet.
- 2. Connect charger DC plug to charger receptacle located on the seat support panel (Figure 14-3, Page 14-6). The charger will activate automatically within 2 to 15 seconds after the DC plug is connected.

Normal Charger Operation, Continued:

- 3. Monitor the ammeter for the correct charge rate. The initial charge rate will vary from 15 to 19 amps, depending upon the condition and depth of discharge of the batteries. Slight variations in the initial charge rate may also result from AC line input voltages which are higher or lower than 120 volts. Higher line voltages increase the initial charge rate while lower line voltages reduce the initial charge rate.
- 4. Monitor the ammeter for about 30 seconds. Under normal operating conditions (when the charger is plugged into a vehicle with discharged batteries), the ammeter will drop to zero for 2 to 3 seconds at the beginning of each charge cycle in order to perform a self-diagnostic test. This test will be repeated at one hour and two hours into the charge cycle. **See following NOTE**.

NOTE

- IF THE BATTERIES ARE IN A FULLY CHARGED STATE AND THE VEHICLE HAS NOT BEEN DRIVEN, THE ONBOARD COMPUTER WILL NOT PERFORM THE SELF-DIAGNOSTIC TEST.
- WHEN AIR TEMPERATURES FALL BELOW 65°F (18.3°C), BATTERIES CHARGED IN UNHEATED AREAS SHOULD BE PLACED ON CHARGE AS SOON AS POSSIBLE AFTER USE. COLD BATTERIES REQUIRE MORE TIME TO FULLY CHARGE.

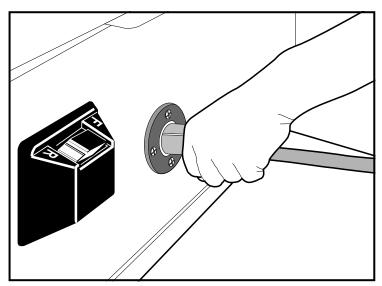


Figure 14-3 Charger Receptacle

Testing Charger Operation

- With the DC plug disconnected from the vehicle charger receptacle, insert the AC cord into an outlet.
 The charger relay should NOT close. A multimeter set to volts DC and connected across the DC plug positive (+) and negative (-) pins should indicate zero volts. No transformer hum should be heard.
- 2. Disconnect the AC cord from its outlet and connect the DC plug to the receptacle. The charger relay should close with an audible "click" after a 2 to 15 second delay.
- 3. If the charger does not operate as in steps 1 or 2 above, refer to the wiring diagram (Figure 14-4, Page 14-7) and make sure the charger is wired correctly.

Always monitor the first charge cycle to make sure the charger turns off properly. If the DC cord is disconnected during a charge, and the batteries are less than 90% charged, the battery warning light will illuminate intermittently. **See Battery Warning Light, Page 14-3**.

CHECKING BATTERY CONDITION AFTER A CHARGE CYCLE

Read DANGER and WARNING on page 14-1.

It is common practice for technicians to check the condition of a set of batteries after they have charged to ensure they have received a complete charge before the vehicle is used. With the PowerDrive Plus this practice is not necessary. The onboard computer controls and monitors the charge cycle. If any problem occurs during a charge cycle, the battery warning light, located above the steering column in the center dash panel, will illuminate intermittently. If the battery warning light is illuminated after a charge cycle, refer to the Trouble-shooting Guide and Flow Charts on pages 14-8 through 14-12. If the specified test procedures do not identify any problems, plug the DC cord into the vehicle and let it charge until the charger shuts off automatically. If a problem is found, correct it and then charge the vehicle. Normal voltage toward the end of a charge cycle should be approximately 59 to 63 volts while the charger is still operating.

START CHARGE CYCLE

- 1. Disconnect the DC plug from the vehicle's charger receptacle.
- 2. WAIT 20 SECONDS, then reconnect the DC cord. See following NOTE.

NOTE

- THE CHARGER WILL NOT OPERATE UNLESS A DELAY OF APPROXIMATELY 20 SECONDS IS OBSERVED.
- 3. Monitor the ammeter for the charge rate. If the vehicle has not been driven since the last charge cycle and the batteries are fully charged, the onboard computer will not perform a self-diagnostic test. The charge cycle will begin and the ammeter will NOT drop to zero. If the vehicle has been driven, even if only a few feet, the onboard computer will perform the self-diagnostic test; the ammeter will drop to zero for 2 to 3 seconds before the charge cycle begins.

WARNING

• KNOWLEDGE OF BATTERY CHARGER WIRING AND COMPONENT TERMINOLOGY IS REQUIRED BEFORE ATTEMPTING ANY REPAIRS (FIGURES 14-4 AND 14-5, PAGES 14-7 AND 14-8).

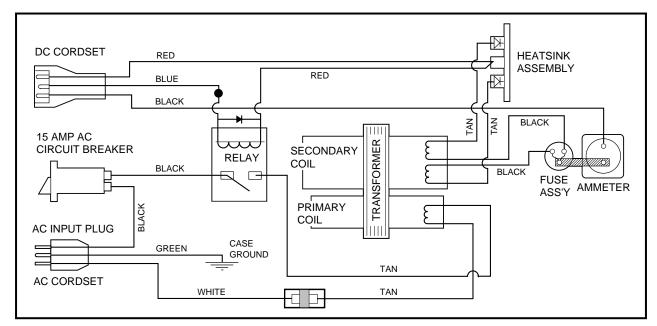


Figure 14-4 PowerDrive Battery Charger Wiring Diagram

14 POWERDRIVE BATTERY CHARGER Troubleshooting

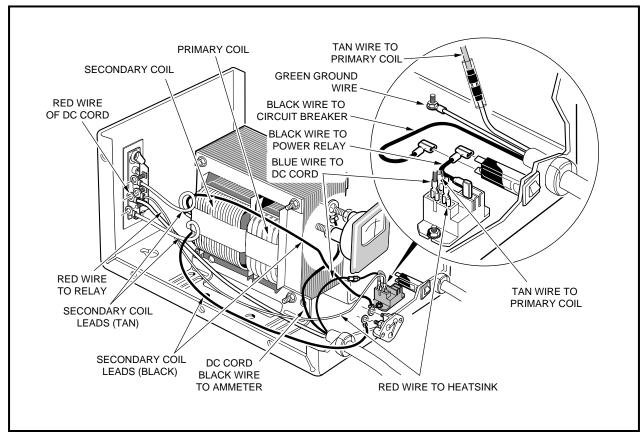


Figure 14-5 PowerDrive Battery Charger

TROUBLESHOOTING

Read DANGER and WARNING on page 14-1.

Use the following information (Pages 14-8 through 14-12) as a guide for troubleshooting PowerDrive Plus vehicles. The Troubleshooting Guide on pages 14-8 and 14-10 encompasses the entire vehicle electrical system. The flow charts on pages 14-10 through 14-11 refer specifically to the onboard computer and battery charger. Test procedures specified in these charts can be found on the pages immediately following.

	POWERDRIVE BATTERY CHARGER TROUBLESHOOTING GUIDE							
	SYMPTOM		POSSIBLE CAUSES	REFER TO				
1.	Relay does not close, no transformer hum and ammeter does not move.	1)	Batteries disconnected.	Section 13–Batteries				
		2)	Battery voltage is too low.	Test Procedure 1, Page 14-12				
		3)	Poor connection between plug and receptacle.	Test Procedure 1, Page 14-12				
		4)	DC plug and cord.	Test Procedures 1 and 5, Pages 14-12 & 14-15				
		5)	Onboard computer malfunction.	Test Procedure 2, Page 14-12				
		6)	Gray sense lead fuse is blown.	Test Procedure 1, Page 14-12				
		7)	Receptacle fuse link is blown.	Section 12–Electrical Components				

	POWERDRIVE BATTERY CHARGER TROUBLESHOOTING GUIDE						
	SYMPTOM		POSSIBLE CAUSES	REFER TO			
2.	Relay closes with an audible click but no transformer hum and ammeter does not move.	1)	Improper AC outlet voltage.	Test Procedure 3, Page 14-13			
		2)	Failed AC plug and cord.	Test Procedure 3, Page 14-13			
		3)	Internal AC breaker.	Test Procedure 3, Page 14-13			
		4)	Transformer primary coil.	Test Procedure 6, Page 14-16			
		5)	Relay	Test Procedure 8, Page 14-17			
3.	Relay closes and transformer hums but ammeter does not move.	1)	Blown charger fuse.	Test Procedure 4, Page 14-14			
		2)	Both diodes failed.	Test Procedure 4B, Page 14-14			
		3)	Onboard computer malfunction.	Test Procedure 2, Page 14-12			
		4)	Failed transformer.	Test Procedure 6, Page 14-16			
4.	Relay operates intermittently.	1)	Blown fuse on red lead from OBC.	Section 11–Electrical System & Testing			
		2)	Failed charger relay.	Test Procedure 8, Page 14-17			
5.	Single charger fuse link blows.	1)	Diode failed.	Test Procedure 4-A, Page 14-14			
		2)	Loose internal fuse connection.	Tighten connection.			
6.	Both charger fuse links blow or receptacle fuse link blows.	1)	Battery is wired in reverse polarity.	Test Procedure 4-B, Page 14-14			
		2)	DC cord is wired in reverse polarity.	Test Procedure 4-B, Page 14-14			
		3)	Both diodes failed.	Test Procedure 4-B, Page 14-14			
7.	Charger output is low.	1)	One diode failed.	Test Procedure 4-A, Page 14-14			
		2)	Transformer coil short-circuit failure.	Test Procedure 6, Page 14-16			
		3)	Onboard computer malfunction.	Test Procedure 2, Page 14-12			
8.	Charger turns off too soon.	1)	AC power supply was shut off.	Test Procedure 3, Page 14-13			
		2)	Onboard computer malfunction.	Test Procedure 2, Page 14-12			
		3)	Batteries may be fully charged.	Test Procedure 7, Page 14-17			
9.	Charger goes to 16 hour time out.	1)	Onboard computer malfunction.	Test Procedure 2, Page 14-12			
		2)	Extremely discharged batteries or cold temperature.	Recharge batteries.			
		3)	Failed battery.	Section 13–Batteries			
10.	AC line fuse or circuit breaker blows.	1)	AC cord is shorted.	Test Procedure 8, Page 14-17			
		2)	Failed transformer.	Test Procedure 6, Page 14-16			
11.	Battery trouble light illuminates for ten seconds, at four second intervals (with DC charger cord plugged in).	1)	AC power interrupted.	Test Procedure 3, Page 14-13			
		2)	Onboard computer malfunction.	Test Procedure 2, Page 14-12			
		3)	Charger failure.	See page 14-7			
		4)	16 hour time out.	See page 14-3			
		5)	Battery or batteries need to be replaced.	Section 13–Batteries			
12.	Battery trouble light illuminates for ten seconds, at four second intervals (with DC charger cord disconnected)	1)	Batteries are getting close to full discharge capacity.	Recharge batteries (golf round may be completed first).			
		2)	Onboard computer malfunction.	Test Procedure 2, Page 14-12			
		3)	Battery or batteries need to be replaced.	Section 13–Batteries			

14 POWERDRIVE BATTERY CHARGER Troubleshooting

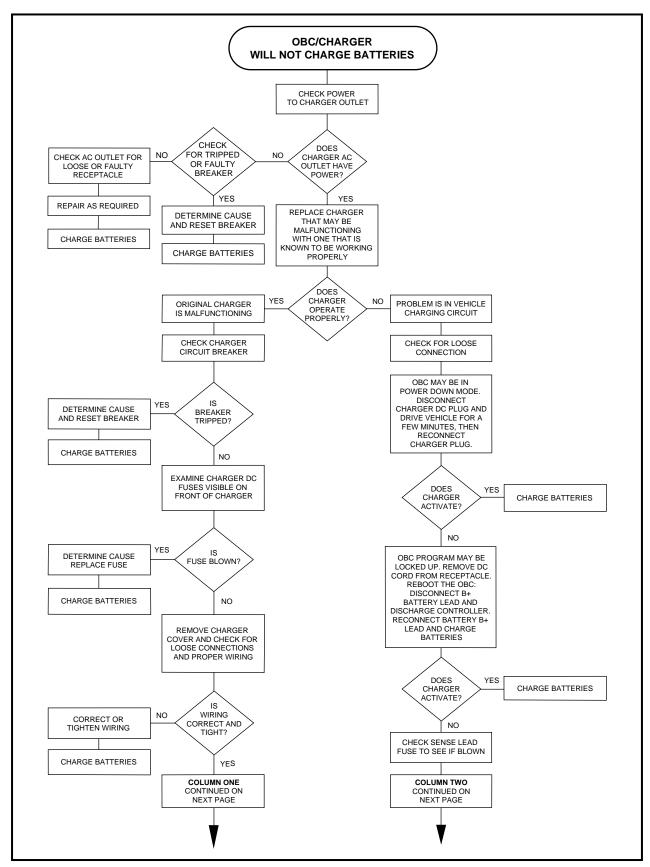


Figure 14-6 Flow Chart

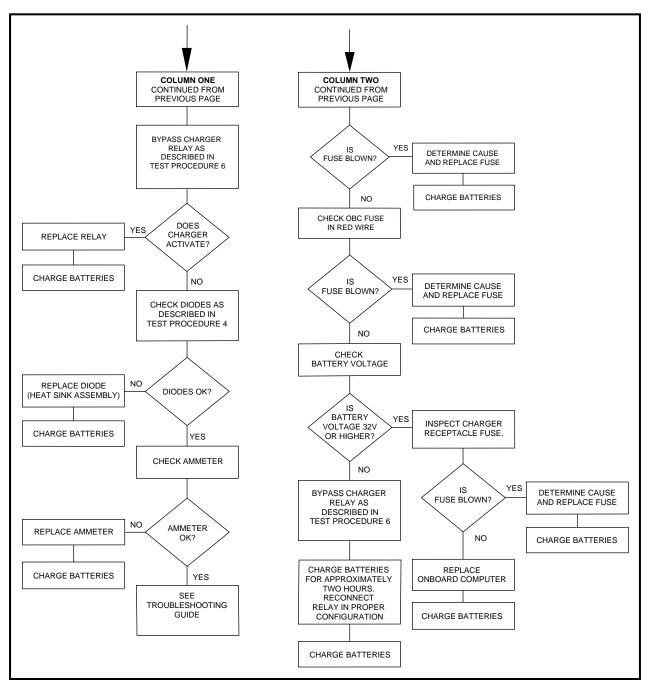


Figure 14-7 Flow Chart, Continued

TEST PROCEDURES

GENERAL INFORMATION

The charger uses DC battery voltage through the onboard computer to close the charger relay which activates the charger AC circuit. When the charger is operating properly, there is a 2 to 15 second delay after the DC cord is plugged into the vehicle before the relay closes. This delay allows time for the DC plug to make a secure connection with the receptacle before the AC circuit is activated and AC power is supplied to the primary coil of the transformer. When the relay closes an audible "click" can be heard, and then as power is supplied, the transformer should hum and the ammeter should indicate the charge rate.

INDEX OF TEST PROCEDURES

- 1. Battery Voltage is Too Low or Faulty Connection Between Plug and Receptacle
- 2. Onboard Computer
- 3. AC Power and Continuity Check of AC Circuit
- 4. Diodes
- 5. Charger DC Circuit Continuity Test
- 6. Transformer
- 7. Battery State of Charge
- 8. Continuity

Test Procedure 1– Battery Voltage is Too Low or Faulty Connection Between Plug and Receptacle

Read DANGER and WARNING on page 14-1.

- 1. Check the DC plug and receptacle for damage, dirt, corrosion, or any condition that might prevent a good electrical connection.
- 2. Inspect the receptacle contacts to ensure that they are not damaged and they are firmly seated within the receptacle.
- 3. Check the wire connections to the charger receptacle:
 - 3.1. Verify the 10 gauge red wire from the charger receptacle is connected to the positive post of battery No. 1 (Figure 14-9, Page 14-13).
 - 3.2. Make sure the two nuts that secure the two 10 gauge black wires to the receptacle fuse assembly are tight (Figure 14-8, Page 14-13).
 - 3.3. Check the connections of the 18 gauge gray wire from the receptacle to the sense lead fuse, and from the sense lead fuse to the onboard computer gray wire (Figure 14-8, Page 14-13).

WARNING

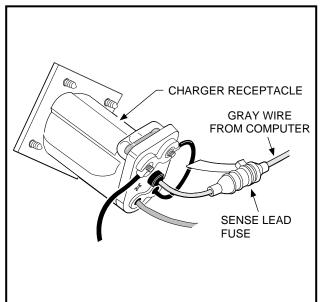
- DO NOT BYPASS THE SENSE LEAD FUSE!
 - 3.4. Remove the gray sense lead fuse assembly and check its continuity with an multimeter set to 200 Ω (ohms). The resistance should be less than 2 Ω (ohms).
- 4. With multimeter set to 200 volts DC, measure the voltage of the battery pack between the positive post of battery No. 1 and the negative post of battery No. 6 (Figure 14-9, Page 14-13). Normal no-load voltage will be 50 to 52 volts for fully charged batteries. The voltage of the battery pack must be over 32 volts DC to allow the onboard computer to close the charger relay. If battery pack voltage is too low to start charger, see Charging a Battery Pack that has Low Voltage, Page 14-25.

Test Procedure 2– Onboard Computer

Read DANGER and WARNING on page 14-1.

- 1. Check the circuit breaker on the front of the charger and reset if necessary.
- Select a second charger that is normally connected to another vehicle and is known to operate properly. Leave the AC cord of the second charger connected to the AC outlet that it normally is connected to. This will ensure AC power is present.
- 3. Insert the DC cord from the second charger into the receptacle of vehicle that is not charging properly
- 4. If the second charger fails in the same manner as the first charger, then the vehicle charging circuit is not functioning properly. **See Troubleshooting, Page 14-8**.

5. Connect the first charger into another vehicle that is known to be functioning properly. If the charger performs as it should, then the charger is not in need of repair.



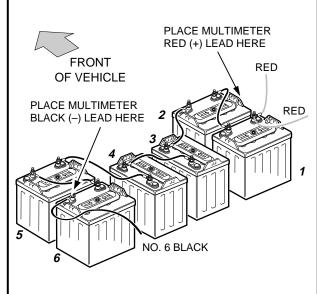


Figure 14-8 Receptacle Wire Connections

Figure 14-9 Battery Pack

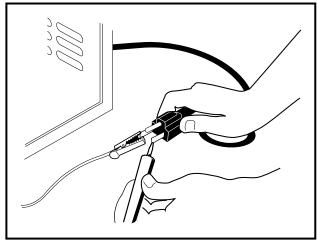


Figure 14-10 Test AC Cord

Test Procedure 3– AC Power and Continuity Check of AC Circuit Read DANGER and WARNING on page 14-1.

- 1. Disconnect the AC power supply cord from the outlet and the DC plug from the vehicle receptacle.
- 2. Check the AC circuit breaker on the front of the charger and reset it if necessary.
- 3. Check the AC line fuse or circuit breaker in the storage facility.
- 4. With a multimeter set at 500 volts AC, check incoming AC voltage. Insert blades into outlet; voltage should be 105 to 128 volts. If proper voltage is not present, have building wiring checked by a licensed electrical contractor.
- 5. Check continuity of the AC circuit:
 - 5.1. Remove the charger cover.

- 5.2. Disconnect the tan lead (from the primary coil) and the black lead (from the circuit breaker) from the charger relay. Connect the tan lead to the circuit breaker (Figure 14-15, Page 14-16).
- 5.3. With relay bypassed, there should be continuity across AC cord blades (Figure 14-10, Page 14-13).
- 6. If the circuit is not complete, check the wiring of the AC cord, transformer primary coil leads, internal AC circuit breaker, and jumper wire (Figure 14-15, Page 14-16).
- 7. If the charger is wired correctly, check the continuity of the AC cord, transformer primary coil, and the jumper wire individually (**Test Procedure 8**, **Page 14-17**).

Test Procedure 4– Diodes

Use test procedure 4A for single diode failures and testing of individual diodes. If both diodes have failed, use test procedure 4B.

Procedure 4A – Single Diode Failure

Read DANGER and WARNING on page 14-1.

A single diode failure is indicated by one fuse link blowing (closed circuit diode) or by the charger output being low (open circuit diode). If a diode has failed, the entire heatsink assembly must be replaced. To check diodes:

- 1. Disconnect the AC cord from its outlet and the DC plug from the receptacle, then remove the charger cover.
- 2. Disconnect one transformer secondary coil lead from the diode terminal (Figure 14-11, Page 14-15).
- 3. Using a low voltage continuity tester or multimeter set to diode test function, connect the red (+) tester lead to the diode mounting plate and the black (–) tester lead to a diode terminal and note the reading (Figure 14-11, Page 14-15).
- 4. Reverse the tester leads and check each diode again and note the reading (Figure 14-12, Page 14-15). A diode is designed to conduct current in one direction only; if a diode conducts current (shows continuity) in both directions, the complete heatsink assembly with diodes must be replaced. If a diode does not conduct current (does not show continuity) in either direction, the entire heatsink assembly must be replaced.
- 5. On rare occasions, a single fuse link may melt due to excessive heat. This can be caused by a loose internal fuse connection. Check all three fuse connections inside the charger to be sure they are clean and tight. The proper torque on the fuse link connections is 20 in-lb (2.2 N-m).
- 6. Be sure the charger is wired properly and all connections are clean and tight. See following WARNING.

A WARNING

 IF CONNECTIONS ARE NOT CLEAN AND TIGHT, EXCESSIVE HEAT COULD RESULT WHICH MAY DAMAGE THE CHARGER.

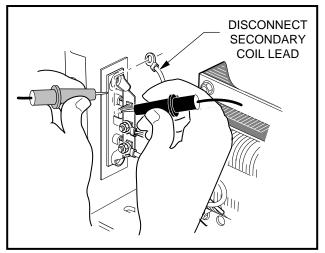
Procedure 4B - Both Diodes Fail

Read DANGER and WARNING on page 14-1.

To check the diodes, use diode test procedure 4A. If both diodes have failed closed, both charger fuse links will be blown. If both diodes have failed open, the relay will close and the transformer will hum, but the ammeter will not indicate any output and the AC circuit breaker may trip off. If both diodes have failed open or closed, the entire heatsink assembly must be replaced. To determine why both diodes failed:

- 1. Check the batteries and the receptacle to be sure they are wired in the correct polarity. Also check the voltage and polarity at the receptacle.
- 2. Make sure the charger DC plug is wired correctly; the red wire should be connected to the center terminal of the heatsink assembly, the blue wire should be connected to the relay coil, and the black wire should be connected to the left side of the ammeter (when viewed from inside the charger). If a reverse polarity connection is made between the charger and the batteries, both fuse links will blow when the DC cord is plugged into the vehicle, whether or not the AC cord is plugged into an outlet.

- 3. On rare occasions, both diodes may fail as the result of a lightning strike at the charging location.
- 4. Excessive heat due to a loose connection may also cause both fuse links to melt. Be sure fuse connections are tightened to 20 in-lb (2.2 N-m).
- 5. Be sure the charger is wired properly and all connections are clean and tight.



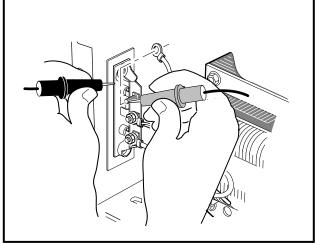
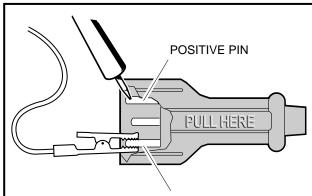


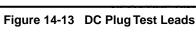
Figure 14-11 Diode Test

Figure 14-12 Diode Test-Reverse Probe Position

Test Procedure 5– Charger DC Circuit Continuity Test Read DANGER and WARNING on page 14-1.

- 1. Using a continuity tester (Club Car Part No. 1011273) or multimeter set to 200 Ω (ohms), connect the test leads to the pins marked (+) and (–) on the DC plug (Figure 14-13, Page 14-15) and note the readings.
- 2. Reverse the test leads and check the DC plug again (Figure 14-14, Page 14-15). The circuit should show continuity in only one direction.
- 3. If the circuit does not show continuity in either direction and the charger fuse is not blown, individually check the continuity of the DC plug and cord (Test Procedure 8), ammeter (Test Procedure 8), diodes (Test Procedure 4A), and all connections.





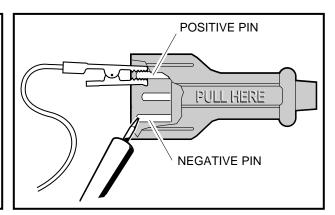


Figure 14-14 DC Plug Reverse Test Leads

4. If the circuit shows continuity in both directions, a short circuit exists in the charger DC circuit, usually caused by failed diodes. **See Test Procedure 4**. If diodes have not failed, check the DC output cord for a short circuit as described in **Test Procedure 8**.

Test Procedure 5-Charger DC Circuit Continuity Test, Continued:

5. Remove the blue wire from the red wire connected to the charger relay and check the continuity between the positive and negative pins and the middle pin on the DC plug (Figures 14-4 and 14-5, Pages 14-7 and 14-8). There should be no continuity.

Test Procedure 6- Transformer

Read DANGER and WARNING on page 14-1.

Failure of the transformer may be caused by aging or a short circuit in adjacent coil turns. If the transformer has failed, the ammeter would indicate low output or no output; however, transformer may hum. A blown AC line fuse or circuit breaker in the charger and/or storage facility may be caused by a failed transformer. To test the transformer:

- Disconnect transformer secondary coil leads Nos. 1 and 5 from heatsink assembly (Figure 14-15, Page 14-16).
- 2. To apply AC power directly to the transformer primary coil, the relay must be bypassed.
 - 2.1. To bypass the relay, remove the black wire (3) from the circuit breaker and disconnect the tan wire (4) from the relay. Connect the tan wire to the circuit breaker (Figure 14-15, Page 14-16).
- 3. Be sure secondary coil leads are not touching one another. With relay bypassed, insert AC plug into an outlet. If AC line fuse or circuit breaker blows, the transformer is shorted internally and must be replaced.
- 4. If the AC line fuse or circuit breaker does not blow, check the transformer secondary voltage across lead Nos.1 and 5 using a multimeter set to 500 volts AC. If measured voltages are approximately 85 volts AC or lower for the secondary coil, the transformer is shorted internally and must be replaced (Figure 14-15, Page 14-16). See following DANGER.

A DANGER

- DO NOT ALLOW SECONDARY COIL LEADS TO TOUCH ONE ANOTHER. THERE ARE APPROXIMATELY 120 VOLTS PRESENT.
- 5. If the transformer output measurements are 86 volts AC or higher, disconnect the AC plug from its outlet.
- 6. If the voltage readings are normal, the transformer is good. Refer to Test Procedure 5 for further tests of the DC circuit.

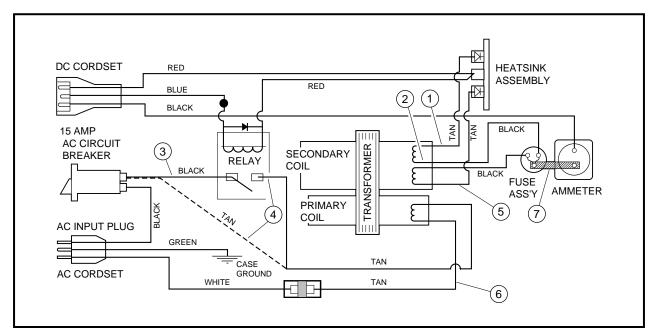


Figure 14-15 Transformer Test Wiring Diagram

Test Procedure 7– Battery State of Charge Read DANGER and WARNING on page 14-1.

- 1. After the charger has shut off, disconnect the DC charger plug for approximately 20 seconds and then reconnect it. The ammeter should jump to 14 to 18 amps and then taper to below 5 amps within 15 minutes. If it does taper to below 5 amps within 15 minutes, batteries are fully charged and the charger is functioning properly.
- 2. If the charger does not taper to below 5 amps within 15 minutes, batteries may not be receiving a full charge and the onboard computer should be checked. **See Test Procedure 2**.

NOTE

OLD BATTERIES NEAR THE END OF USEFUL SERVICE MAY NOT TAPER TO BELOW 5 AMPS.
 SEE SECTION 13-BATTERIES.

Test Procedure 8– Continuity Read DANGER and WARNING on page 14-1.

AC Cord and Plug

Check continuity of the AC cord (Figure 14-16, Page 14-17).

- 1. Disconnect the AC cord from the outlet and the DC plug from the receptacle, then remove the charger cover.
- 2. Disconnect black wire (1) of AC cord from charger AC circuit breaker (3) (Figure 14-16, Page 14-17).
- 3. Disconnect green wire (2) from charger case and position it so it does not touch any metal part of the charger (Figure 14-16, Page 14-17).
- 4. Using a multimeter, set for 200 Ω (ohms), place the red probe on the terminal at the end of the black wire (1) **(Figure 14-16, Page 14-17)**. Test for continuity on each of the flat blades and then on the round pin of the AC plug. Continuity should register on one flat blade only. If any other reading is obtained, the AC cord and plug must be replaced.
- 5. Put the red probe on the end of the green wire (2) and with the black probe check for continuity on both flat blades and on the round pin of the AC plug (Figure 14-16, Page 14-17). Tester should register continuity on only the round pin. If any other reading is obtained, the AC cord and plug must be replaced.

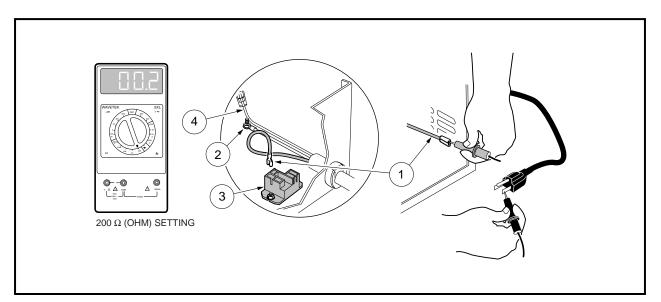


Figure 14-16 AC Cord and Plug Continuity Test

AC Cord and Plug, Continued:

6. Disconnect the white wire (4) from the tan wire (Figure 14-16, Page 14-17). Put red probe on the white wire and check for continuity on both flat blades and on the ground pin of the AC plug (Figure 14-16, Page 14-17). Tester should register continuity on only one flat blade. If any other reading is obtained, the AC cord and plug must be replaced.

DC Cord and Plug

- 1. Disconnect the AC cord from the outlet and the DC plug from the receptacle, then remove the charger cover.
- 2. To check the continuity of the DC cord, disconnect the black wire of the DC cord from the ammeter (Figure 14-17, Page 14-20).
- 3. Disconnect the red wire of the DC cord from the heatsink assembly (Figure 14-17, Page 14-20).
- 4. Disconnect the blue wire from the red wire assembly that connects to the charger relay (Figure 14-17, Page 14-20).
- 5. Place the clip of the continuity tester on the red wire of the DC cord (Figure 14-17, Page 14-20).
- 6. Place the continuity tester probe on the positive (+) pin of the DC plug (the positive (+) pin and negative (-) pin are identified on the plug). If tester does not register continuity, cord and plug must be replaced.
- 7. Place the continuity tester probe on the negative (–) pin of the DC plug. Tester should register no continuity. If tester registers continuity, cord and plug must be replaced.
- 8. Place the continuity tester probe on the unmarked (middle) pin of the DC plug. Tester should register no continuity. If tester registers continuity, cord and plug must be replaced.
- 9. Move the continuity tester clip to the black wire of the DC cord (Figure 14-17, Page 14-20).
- 10. Place the continuity tester probe on the negative (–) pin of the DC plug. Tester should register continuity. If tester does not register continuity, cord and plug must be replaced.
- 11. Place the continuity tester probe on the unmarked (middle) pin of the DC plug. Tester should register no continuity. If tester registers continuity, cord and plug must be replaced.
- 12. Move continuity tester probe to the blue wire of the DC cord (Figure 14-17, Page 14-20). Check for continuity at the middle pin. Tester should register continuity. If tester does not register continuity, replace DC cord.

Transformer

A WARNING

 BEFORE PERFORMING THIS TEST, BE SURE THE AC PLUG IS NOT CONNECTED TO AN AC OUTLET.

The PowerDrive battery charger transformer has two coils: a primary coil and a secondary coil (Figure 14-15, Page 14-16).

Primary Coil

- Disconnect both AC and DC cords and remove charger cover. See preceding WARNING.
- 2. Disconnect terminals from transformer tan primary leads (4) and (6) (Figure 14-15, Page 14-16).
- 3. Place the continuity tester leads on the disconnected primary coil leads. Tester should register continuity. If tester does not register continuity, replace the transformer.

Secondary Coil

- Disconnect both AC and DC cords and remove charger cover. See preceding WARNING.
- 2. Remove the transformer (tan) secondary coil lead (1) from the upper terminal of the heatsink assembly (Figure 14-15, Page 14-16). See following DANGER.

A DANGER

- DO NOT ALLOW SECONDARY COIL LEADS TO TOUCH ONE ANOTHER. THERE ARE APPROXIMATELY 120 VOLTS PRESENT.
- 3. Remove the other transformer (tan) secondary coil lead (5) from the bottom terminal of the heatsink assembly and place the tester clip on the ammeter bus bar (7) (Figure 14-15, Page 14-16). Place the continuity leads on each (tan) secondary coil lead. Tester should register continuity. If tester does not register continuity, replace transformer. Be sure the fuse is intact and not blown.

Voltage Suppressor – Failed Closed

- 1. Disconnect both AC and DC plugs. See preceding WARNING.
- 2. Connect red (+) lead of multimeter (with alligator clips) to the positive pin of the DC plug.
- 3. Connect black (–) clip to the sense lead pin (short pin) of the DC plug. With the multimeter set on diode check (audible setting), multimeter should indicate no tone. If a tone is emitted (indicating a closed circuit) then the voltage suppressor has failed and should be replaced. **See following NOTE.**

NOTE

• FAILURE IN A CLOSED CONDITION CAN ALSO BE DETERMINED BY PLUGGING THE CHARGER INTO A VEHICLE, THEN UNPLUGGING CHARGER AND VISUALLY INSPECTING THE SENSE LEAD FUSE AT THE GRAY WIRE. IF FUSE IS BLOWN, THEN VOLTAGE SUPPRESSOR HAS FAILED CLOSED AND BOTH FUSE AND VOLTAGE SUPPRESSOR SHOULD BE REPLACED. THE VOLTAGE SUPPRESSOR CANNOT BE TESTED FOR FAILURE IN AN OPEN CONDITION. FAILURE IN AN OPEN CONDITION WILL HAVE NO AFFECT ON VEHICLE CHARGING OPERATION DUE TO THE EXISTENCE OF A SIMILAR COMPONENT LOCATED IN THE ONBOARD COMPUTER.

Relay

- 1. Disconnect both AC and DC plugs and remove charger cover. See preceding WARNING.
- 2. Remove the black (3) and tan (4) wires from the contact terminals of the relay (Figure 14-15, Page 14-16). Place continuity tester leads on contact terminals of the relay. Tester should register no continuity. If tester registers continuity, the relay contacts are welded shut and the relay must be replaced.
- 3. Place continuity leads on contact terminals of relay. With batteries connected, insert the DC plug into the receptacle. Tester should register continuity. If tester does not register continuity, the relay must be replaced.

Ammeter

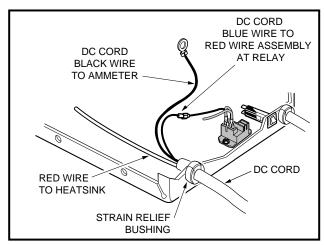
Check continuity of the ammeter:

- Disconnect both AC and DC plugs and remove charger cover. See preceding WARNING.
- 2. Disconnect the black wire from the left ammeter post (as viewed from inside the charger).
- 3. Place the continuity tester clip on one of the ammeter posts.
- 4. Place the continuity tester probe on the other ammeter post. The tester should register continuity. If the tester does not register continuity, replace ammeter.

PLUG AND CORD REPLACEMENT

Read DANGER and WARNING on page 14-1.

The charger cord, plug, and receptacle are wear items and should be inspected daily. Visually inspect them for cracks, loose connections, and frayed wiring; they must be replaced when worn or damaged. If charger plug and receptacle show signs of corrosion or are difficult to insert and remove, the receptacle contacts and plug blades may be cleaned with a good electrical contact cleaner or lightly sprayed with WD-40® brand spray lubricant. See Section 12, Page 12-10 for charger receptacle replacement.



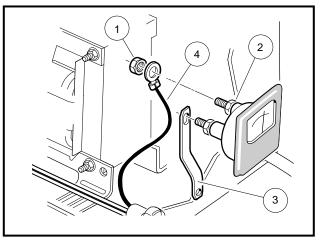


Figure 14-17 DC Cord

Figure 14-18 Charger Cord Installation

CHARGER CORD AND PLUG REPLACEMENT Read DANGER and WARNING on page 14-1.

Charger Cord and Plug Removal

- 1. Disconnect both AC and DC plugs and remove the charger cover.
- 2. Remove the black lead of the charger DC cord (4) from the ammeter by loosening the nut (1). Support the terminal as the nut is loosened to prevent rotation of the connection (Figure 14-18, Page 14-20).
- 3. Remove nut attaching red lead of charger DC cord onto the heatsink assembly (Figure 14-17, Page 14-20).
- Disconnect the DC cord blue wire from the red wire assembly that connects to the charger relay (Figure 14-17, Page 14-20).
- 5. Using pliers, squeeze the strain relief bushing and remove the cord set (Figure 14-17, Page 14-20).

Charger Cord and Plug Installation

- 1. Insert the leads of the new cord through the hole in the charger base.
- 2. Attach the red lead of the new cord set to the center terminal of the heatsink and tighten the nut to 14 in-lb (1.6 N-m) (Figure 14-17, Page 14-20).
- 3. Attach the blue lead of new cord set to the red wire assembly at the charger relay (Figure 14-17, Page 14-20).
- 4. Attach the black lead of the new cord to the ammeter. Install nut (1) onto post of ammeter slightly more than finger tight. While holding the inside nut (2), tighten the outside nut (1) 1/4 turn (Figure 14-18, Page 14-20). See following CAUTION.

A CAUTION

- DO NOT ALLOW AMMETER POST TO ROTATE AS THE NUT IS TIGHTENED. IF IT IS ALLOWED TO ROTATE, THE AMMETER COULD BE DAMAGED.
- 5. Using pliers, put the strain relief bushing on the cord and insert into the charger base.
- 6. Position the charger cover on the base. Install the mounting screws, starting with the bottom holes. Tighten the screws to 11 in-lb (1.2 N-m).

CHARGER REPAIRS

HEATSINK ASSEMBLY

Read DANGER and WARNING on page 14-1.

Heatsink Assembly Removal

- 1. Disconnect the AC and DC cords and remove the charger cover.
- Remove both secondary transformer leads (tan) from the heatsink assembly (Figures 14-4 and 14-5, Pages 14-7 and 14-8).
- 3. Remove the two red wires from the heatsink assembly (Figures 14-4 and 14-5, Pages 14-7 and 14-8).
- 4. Remove the nuts and bolts that secure the heatsink assembly to the case.

Heatsink Assembly Installation

- 1. Place heatsink against charger base. Make sure clear plastic insulator sheet is between the heatsink and the charger base. Install the nuts and bolts that secure the heatsink assembly to the case. Tighten the bolts to 22 in-lb (2.4 N-m) (Figures 14-4 and 14-5, Pages 14-7 and 14-8).
- 2. Connect the red wire from the DC cord and the red wire from the charger relay to the center terminal post on the heatsink assembly. Tighten nut to 18 in-lb (2.0 N-m) (Figures 14-4 and 14-5, Pages 14-7 and 14-8).
- 3. Connect one of the secondary transformer leads (tan) to the bottom terminal post of the heatsink assembly. Tighten nut to 18 in-lb (2.0 N-m) (Figures 14-4 and 14-5, Pages 14-7 and 14-8).
- 4. Connect the other secondary transformer lead (tan) to the top terminal post of the heatsink assembly. Tighten nut to 18 in-lb (2.0 N-m) (Figures 14-4 and 14-5, Pages 14-7 and 14-8).
- 5. Replace charger cover and check charger for proper operation.

TRANSFORMER

Read DANGER and WARNING on page 14-1.

Transformer Removal

- 1. Disconnect the AC and DC cords and remove the charger cover.
- 2. Disconnect tan primary coil lead from the charger relay, then disconnect the tan primary coil lead from the white wire in the AC cord (Figures 14-4 and 14-5, Pages 14-7 and 14-8).
- 3. Disconnect the two tan secondary transformer leads from the heatsink assembly (Figures 14-4 and 14-5, Pages 14-7 and 14-8).
- 4. Disconnect the two black secondary transformer leads from the fuse assembly (Figures 14-4 and 14-5, Pages 14-7 and 14-8).
- 5. Remove four bolts and nuts mounting transformer to case and remove transformer (Figures 14-4 and 14-5, Pages 14-7 and 14-8).

Transformer Installation

- 1. Install the transformer with the secondary coil to the rear of the charger case. Tighten the four bolts and nuts to 28 in-lb (3.2 N-m) (Figures 14-4 and 14-5, Pages 14-7 and 14-8).
- 2. Connect one secondary transformer lead (tan) to the top terminal post of the heatsink assembly (Figures 14-4 and 14-5, Pages 14-7 and 14-8). Tighten nut to 18 in-lb (2.0 N-m).
- 3. Connect the other secondary transformer lead (tan) to the bottom terminal post of the heatsink assembly (Figures 14-4 and 14-5, Pages 14-7 and 14-8). Tighten nut to 18 in-lb (2.0 N-m).
- 4. Connect one secondary transformer lead (black) to one terminal of the fuse assembly (Figures 14-4 and 14-5, Pages 14-7 and 14-8). Tighten nut to 22 in-lb (2.5 N-m).

Transformer Installation, Continued:

- 5. Connect the other secondary transformer lead (black) to the remaining terminal of the fuse assembly (Figures 14-4 and 14-5, Pages 14-7 and 14-8). Tighten nut to 22 in-lb (2.5 N-m).
- 6. Connect the tan primary lead to the charger relay (Figures 14-4 and 14-5, Pages 14-7 and 14-8).
- 7. Connect other tan primary lead to white wire from AC cord (Figures 14-4 and 14-5, Pages 14-7 and 14-8).
- 8. Replace charger cover and check charger for proper operation.

AMMETER

Read DANGER and WARNING on page 14-1.

Ammeter Removal

- 1. Disconnect the AC and DC cords and remove the charger cover.
- 2. Disconnect black wire from DC cord (5), and bus bar (3) from ammeter (Figure 14-19, Page 14-22).
- 3. Remove the two nuts (2) that secure the ammeter to the charger face (Figure 14-19, Page 14-22).
- 4. Remove the ammeter from the face of the charger.

Ammeter Installation

- 1. Place the ammeter in position in the charger face (Figure 14-19, Page 14-22).
- 2. Install the nuts (2) and tighten until ammeter is firmly secured (Figure 14-19, Page 14-22).
- 3. Connect the black wire of the DC cord (5) to the left (as viewed from inside the charger) post of the ammeter (Figure 14-19, Page 14-22).
- 4. Connect the bus bar (3) from the fuse link to the right post of the ammeter. Place flat washers on both sides of the bus bar (Figure 14-19, Page 14-22).
- 5. Thread nuts onto both posts of ammeter until just past finger tight. While holding the inside nut, tighten the outside nut 1/4 turn (Figure 14-19, Page 14-22). See following CAUTION.

A CAUTION

- DO NOT ALLOW AMMETER POST TO ROTATE AS THE NUT (4) IS TIGHTENED. IF IT IS ALLOWED TO ROTATE, THE AMMETER COULD BE DAMAGED (FIGURE 14-19, PAGE 14-22).
- 6. Replace the charger cover. Plug the charger into the vehicle and check ammeter for proper operation.

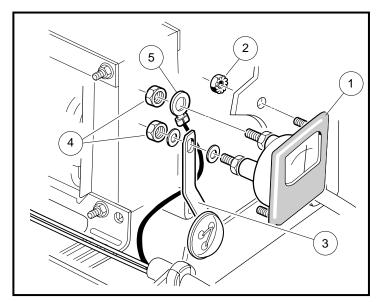


Figure 14-19 Ammeter Removal

FUSE LINK

Read DANGER and WARNING on page 14-1.

Fuse Link Removal

- 1. Disconnect the AC and DC cords and remove the charger cover.
- Remove both black secondary transformer leads and the bus bar from the back of the fuse link assembly (Figure 14-19, Page 14-22).
- 3. Remove screws from the front of the charger and remove the fuse link assembly.

Fuse Link Installation

- 1. Place plastic cover over fuse assembly and install mounting screws from front of charger face. The center branch of the fuse assembly should be in the upper left corner when viewed from the front of the charger.
- 2. Install the bus bar over the center branch of the fuse assembly and ammeter post (Figure 14-19, Page 14-22). Tighten to 27 in-lb (3.0 N-m).
- 3. Install a secondary transformer lead (black) to one of the two remaining terminals on the back of the fuse assembly. Install the remaining secondary transformer lead (black) to the remaining terminal (Figure 14-19, Page 14-22). Tighten to 27 in-lb (3.0 N-m).
- 4. Replace charger cover.

VOLTAGE SUPPRESSOR

Read DANGER and WARNING on page 14-1.

The voltage suppressor protects the onboard computer by capturing very high, but very brief voltage spikes which occur due to the collapse of the electrical field in the charger relay when the charger is disconnected from the vehicle. See also Test Procedure 8–Continuity, Voltage Suppressor, Page 14-19.

Voltage Suppressor Removal

- 1. Disconnect the AC and DC cords and remove the charger cover.
- 2. Remove nut attaching voltage suppressor (18 gauge red wire) to heatsink (Figure 14-20, Page 14-24).
- 3. Disconnect blue wire to DC cord at quick disconnect terminal (Figure 14-20, Page 14-24).
- 4. Disconnect voltage suppressor from charger relay (Figure 14-20, Page 14-24).

Voltage Suppressor Installation

1. Install in reverse order of removal. Tighten nut attaching voltage suppressor (18 gauge red wire) to heatsink to 18 in-lb (2.0 N-m). **See following NOTE.**

NOTE

• THE CHARGER RELAY BLADE CONNECTOR IS LOCATED OFF-CENTER WITHIN THE RELAY HOUSING. WHEN CONNECTING VOLTAGE SUPPRESSOR SLIP-ON CONNECTOR TO RELAY BLADE CONNECTOR, MAKE SURE SLIP-ON CONNECTOR IS POSITIONED SO THAT FLAT SIDE OF CONNECTOR IS CLOSEST TO RELAY HOUSING. SEE FIGURE 14-20, PAGE 14-24.

CHARGER RELAY

Read DANGER and WARNING on page 14-1.

Charger Relay Removal

- 1. Disconnect the AC and DC cords and remove the charger cover.
- 2. Disconnect the red, blue, black, and primary coil wires from the relay (Figure 14-20, Page 14-24).

Charger Relay Removal, Continued:

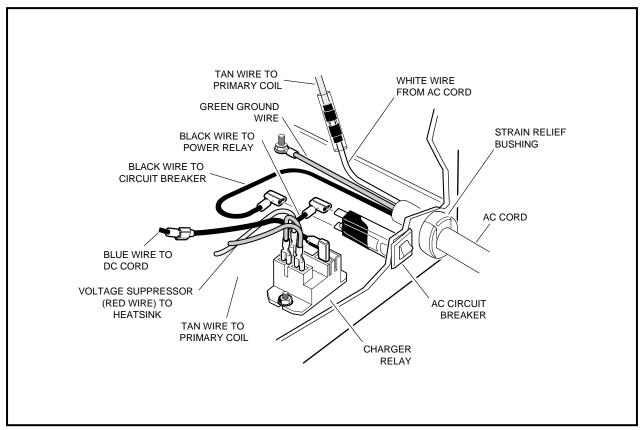


Figure 14-20 Charger Relay

- 3. Remove the two nuts and lock washers attaching relay to charger base (Figure 14-20, Page 14-24).
- 4. Remove the relay.

Charger Relay Installation

1. Install in reverse order of removal. Connect wires as shown in **Figure 14-20**, **Page 14-24**. Tighten nut connecting relay to charger base to 18 in-lb (2.0 N-m).

CHARGER AC CIRCUIT BREAKER

Read DANGER and WARNING on page 14-1.

AC Circuit Breaker Removal

- 1. Disconnect the AC and DC cords and remove the charger cover.
- 2. Disconnect the two black wires attached to circuit breaker (Figure 14-20, Page 14-24).
- 3. With a pair of pliers, squeeze in the retaining tabs on the sides of the circuit breaker and remove the circuit breaker through its mounting hole in the face of the charger (Figure 14-20, Page 14-24).

AC Circuit Breaker Installation

1. Install in reverse order of removal.

CHARGER AC CORD

Read DANGER and WARNING on page 14-1.

AC Cord Removal

- 1. Disconnect the AC and DC cords and remove the charger cover.
- 2. Disconnect the AC cord black wire at the circuit breaker (Figure 14-20, Page 14-24).
- 3. Disconnect the AC cord white wire at the primary coil tan wire (Figure 14-20, Page 14-24).
- 4. Disconnect the AC cord green wire at the charger base (Figure 14-20, Page 14-24).
- 5. Use a pair of pliers to grip the strain relief bushing and remove it and the AC cord from the charger.

AC Cord Installation

- 1. Insert the black, white, and green leads of the new AC cord into the charger through the hole in the charger face (Figure 14-20, Page 14-24).
- Connect the black wire to the circuit breaker, the white wire to the primary coil, and the green wire to the charger base. Tighten the screw on the green (ground) wire terminal to 18 in-lb (2 N-m) (Figure 14-20, Page 14-24).
- 3. Position the strain relief bushing on the AC cord.
- 4. Using pliers, install the strain relief bushing and AC cord into the mounting hole in the charger face.
- 5. Install the charger cover.

CHARGING A BATTERY PACK THAT HAS LOW VOLTAGE

Read DANGER and WARNING on page 14-1.

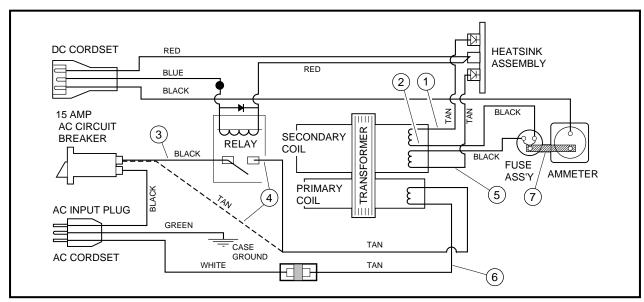


Figure 14-21 PowerDrive Charger Wiring Diagram

- 1. Turn key switch OFF and place the Forward/Reverse rocker switch in NEUTRAL. Leave the batteries connected.
- 2. If battery pack voltage is below 34 volts, the charger will not activate. The charger relay will have to be by-passed in order for the charger to activate.
- 3. Disconnect the DC cord from the charger receptacle and unplug the AC cord from the electrical outlet.
- 4. Remove the eight screws securing the charger cover and remove the cover from the charger.

Charging a Battery Pack with Low Voltage, Continued:

- 5. Inside the charger, locate the black wire (3) that goes from the circuit breaker to the relay and disconnect it from the circuit breaker terminal. Make sure this wire does not touch the charger housing or any other charger component (Figure 14-21, Page 14-25).
- 6. Disconnect the transformer wire (4) from the relay and then connect this wire to the open terminal on the circuit breaker (Figure 14-21, Page 14-25).
- 7. Plug the DC cord into the charger receptacle first, and then plug the AC cord into an electrical outlet.
- 8. The charger should activate and begin to charge the batteries. Allow the charger to operate for one or two hours. **See following WARNING**.

WARNING

- DO NOT LEAVE THE VEHICLE UNATTENDED WHILE IT IS CHARGING. THE CHARGER OPERATING
 WITH A BYPASSED RELAY COULD SHORT CIRCUIT AND POSSIBLY CAUSE A FIRE.
- 9. After one or two hours, disconnect the charger AC cord from the electrical outlet *first*. Then disconnect the DC cord from the charger receptacle in the vehicle.
- 10. Disconnect transformer wire from circuit breaker and connect it to the relay. Reconnect the short black wire from the relay to the circuit breaker (Figure 14-21, Page 14-25).
- 11. Install the charger cover and the eight retaining screws.
- Plug the DC cord into the charger receptacle and plug the AC cord into an electrical outlet.
- 13. Allow the charger to continue charging the batteries until the charger shuts of automatically.
- 14. When the charge cycle is complete, test the batteries again. If the battery pack voltage is above 34 volts and the vehicle will not operate, it will be necessary to troubleshoot the vehicle's electrical system to determine which electrical component has failed. See Section 11–Electrical System and Testing.

SECTION 15-MOTOR

A DANGER

- BATTERY EXPLOSIVE GASES! DO NOT SMOKE. KEEP SPARKS AND FLAMES AWAY. VENTILATE WHEN CHARGING OR USING IN AN ENCLOSED SPACE. ALWAYS WEAR FULL FACE SHIELD AND RUBBER GLOVES WHEN WORKING ON OR NEAR BATTERIES.
- USE EXTREME CAUTION WHEN USING TOOLS, WIRES, OR METAL OBJECTS NEAR BATTERIES! A SHORT CIRCUIT AND (OR) SPARK COULD CAUSE AN EXPLOSION.
- BATTERY POISON! CONTAINS ACID! CAUSES SEVERE BURNS. AVOID CONTACT WITH SKIN, EYES, OR CLOTHING. ANTIDOTES:
 - EXTERNAL: FLUSH WITH WATER, CALL A PHYSICIAN IMMEDIATELY.
 - INTERNAL: DRINK LARGE QUANTITIES OF MILK OR WATER. FOLLOW WITH MILK OF MAGNESIA OR VEGETABLE OIL. CALL A PHYSICIAN IMMEDIATELY.
 - EYES: FLUSH WITH WATER FOR FIFTEEN MINUTES. CALL PHYSICIAN IMMEDIATELY.

A WARNING

- ONLY TRAINED TECHNICIANS SHOULD REPAIR OR SERVICE THIS VEHICLE. ANYONE DOING EVEN SIMPLE REPAIRS OR SERVICE SHOULD HAVE KNOWLEDGE AND EXPERIENCE IN ELECTRICAL AND MECHANICAL REPAIR.
- FOLLOW ALL PROCEDURES EXACTLY AS STATED IN THIS MANUAL, AND HEED ALL DANGER, WARNING AND CAUTION STATEMENTS, AS WELL AS THOSE AFFIXED TO THE VEHICLE.
- WEAR SAFETY GLASSES OR APPROVED EYE PROTECTION WHILE SERVICING VEHICLE.
- PLACE THE TOW/RUN SWITCH IN THE **TOW** POSITION BEFORE CONNECTING OR DISCONNECTING BATTERY WIRES.
- BEFORE PERFORMING ANY TESTS OR REPAIRS THAT DO NOT REQUIRE THE ELECTRICAL SYSTEM TO BE ENERGIZED, MAKE SURE CAPACITORS ARE DISCHARGED. PLACE THE TOW/ RUN SWITCH IN THE TOW POSITION, DISCONNECT BATTERY WIRES, PLACE FORWARD/ REVERSE ROCKER SWITCH IN REVERSE AND LISTEN FOR THE REVERSE BUZZER:
 - IF THE REVERSE BUZZER DOES NOT SOUND, THE CAPACITORS ARE DISCHARGED.
 - IF THE REVERSE BUZZER SOUNDS, TURN THE KEY SWITCH **ON** AND DEPRESS THE ACCELERATOR PEDAL UNTIL THE BUZZER CAN NO LONGER BE HEARD.
- MOVING PARTS! DO NOT ATTEMPT TO SERVICE THE VEHICLE WHILE IT IS RUNNING.
- DO NOT WEAR LOOSE CLOTHING. REMOVE JEWELRY SUCH AS RINGS, WATCHES, CHAINS, ETC. BEFORE SERVICING VEHICLE.
- USE INSULATED TOOLS WHEN WORKING NEAR BATTERIES OR ELECTRICAL CONNECTIONS. USE EXTREME CAUTION TO AVOID SHORTING OF COMPONENTS OR WIRING.
- TO AVOID UNINTENTIONALLY STARTING THE VEHICLE, DISCONNECT BATTERIES AS SHOWN IN **FIGURE 15-1**, **PAGE 15-2**.

GENERAL INFORMATION

The PowerDrive Plus vehicle is equipped with a 48-volt DC, shunt wound, reversible traction motor. The shunt wound motor is designed for use on the PowerDrive Plus vehicle only. Club Car recommends motors requiring major repair be sent to a qualified motor repair shop. However, there are many relatively simple tasks that can be performed by a technician with general knowledge and experience in electric motor repair.

15 MOTOR External Motor Testing

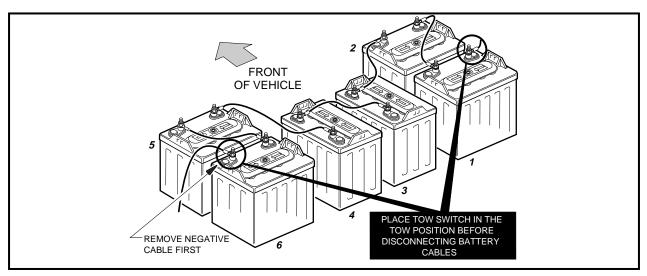


Figure 15-1 PowerDrive Plus Battery Configuration

EXTERNAL MOTOR TESTING

Using a multimeter or continuity tester, the following tests can be performed without disassembling the motor.

NOTE

TAG THE MOTOR WIRES FOR IDENTIFICATION BEFORE DISCONNECTING.

Test Procedure 1 – Internal Short Circuits Read DANGER and WARNING on page 15-1.

- 1. Place Tow/Run switch in the TOW position and disconnect the batteries (Figure 15-1, Page 15-2).
- 2. Using two wrenches to prevent posts from turning, disconnect wires from terminals on motor.
- 3. Using a multimeter set to 200 Ω (ohms), place black (–) probe on motor housing. Scratch through paint to ensure a good connection. Place red (+) probe on A1, A2, F1, and F2 terminals respectively (Figure 15-2, Page 15-2). Multimeter should indicate no continuity. If readings are incorrect, motor will need to be removed from the vehicle and repaired by a qualified technician. See Motor Removal, Page 15-3.
 - 3.1. An incorrect reading from the A1 or A2 terminal indicates three possible problems: a grounded A1 or A2 terminal, a grounded wire in the brush area, or a grounded armature/commutator. An incorrect reading for the F1 or F2 terminal indicates a possible grounded F1 or F2 terminal or field coil.

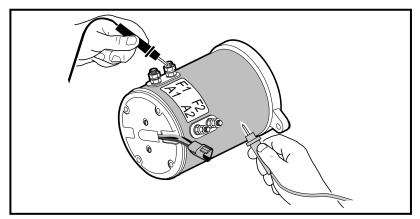


Figure 15-2 Test for Motor Short Circuit

Test Procedure 2 – Armature Circuit Open Read DANGER and WARNING on page 15-1.

- 1. Place Tow/Run switch in the TOW position and disconnect the batteries (Figure 15-1, Page 15-2).
- 2. Using two wrenches to prevent post from turning, disconnect wires from the A1 and A2 terminals on the motor. Using a multimeter set to 200 Ω (ohms), place the red (+) probe on the A1 terminal and black (–) probe on the A2 terminal (Figure 15-2, Page 15-2). The multimeter should indicate continuity. If the reading is incorrect, a possible open or poor contact in a brush assembly and/or open armature windings may be the cause. The motor will need to be removed from the vehicle and repaired by a qualified technician. See Motor Removal.

Test Procedure 3 – Field Circuit Open Read DANGER and WARNING on page 15-1.

- 1. Place Tow/Run switch in the TOW position and disconnect the batteries (Figure 15-1, Page 15-2).
- 2. Using two wrenches to prevent post from turning, disconnect wires from the motor F1 and F2 terminals. Using a multimeter set to 200 Ω (ohms), place the red (+) probe on the F1 terminal and the black (–) probe on the F2 terminal (Figure 15-2, Page 15-2). The multimeter should indicate continuity. If the reading is incorrect, a possible open field coil or bad connections at the terminals may be the cause. The motor will need to be removed from the vehicle and repaired by a qualified technician. See Motor Removal.

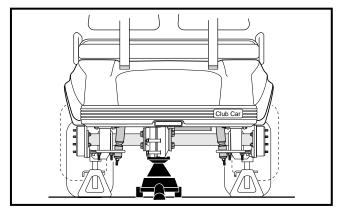


Figure 15-3 Lift Vehicle with Floor Jack

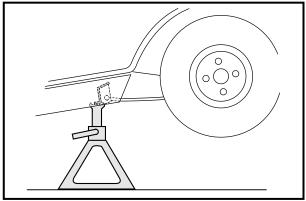


Figure 15-4 Support Vehicle with Jackstands

MOTOR

Read DANGER and WARNING on page 15-1.

Motor Removal

- 1. Place Tow/Run switch in TOW and disconnect battery cables, negative cable first (Figure 15-1, Page 15-2).
- 2. Using two wrenches to prevent posts from turning, disconnect wires from terminals on motor. Label the wires to ensure proper reconnection. **See NOTE on page 15-2.**
- 3. Slightly loosen all the lug nuts on both rear wheels.
- 4. Place floor jack under transaxle and raise rear of vehicle (Figure 15-3, Page 15-3) then place jack-stands under frame cross-member between the spring mount and the side stringer, just forward of each rear wheel. Lower the vehicle to let the jackstands support the vehicle (Figure 15-4, Page 15-3). See following WARNING.

5 MOTOR Motor

Motor Removal, Continued:

A WARNING

 LIFT ONLY ONE END OF THE VEHICLE AT A TIME. BEFORE LIFTING, LOCK THE BRAKES AND CHOCK THE WHEELS THAT REMAIN ON THE FLOOR. USE A SUITABLE LIFTING DEVICE (CHAIN HOIST OR HYDRAULIC FLOOR JACK) WITH 1000 LB. (454 KG.) MINIMUM LIFTING CAPACITY. DO NOT USE LIFTING DEVICE TO HOLD VEHICLE IN RAISED POSITION. ALWAYS USE APPROVED JACKSTANDS OF PROPER WEIGHT CAPACITY TO SUPPORT THE VEHICLE.

- 5. Remove both rear wheels.
- 6. Remove the nut, cup washer, and bushing from the bottom side of the shock absorber. Compress the shock absorber (pushing upwards) to move it out of the way.
- 7. Remove the nuts and bolts mounting the rear leaf springs to the shackles (Figure 15-5, Page 15-4).
- 8. To gain easier access to the motor, lower the transaxle as low as it will go. If more room is needed, remove the jack from beneath the transaxle and allow the springs to rest on the floor (Figure 15-5, Page 15-4).
- 9. Remove the four bolts that mount the motor to the transaxle (Figure 15-16, Page 15-13).

A CAUTION

- DO NOT PLACE FINGERS OR HANDS UNDER MOTOR DURING REMOVAL. SEVERE INJURY COULD RESULT IF FINGERS OR HANDS ARE CAUGHT BETWEEN MOTOR AND AXLE TUBE.
- 10. Carefully slide the motor away from the transaxle until the motor spline disengages the input shaft. Remove the motor from the vehicle.

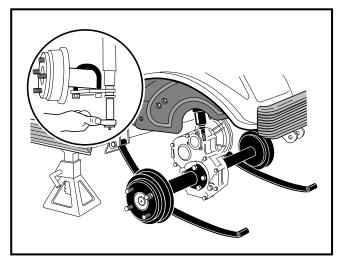
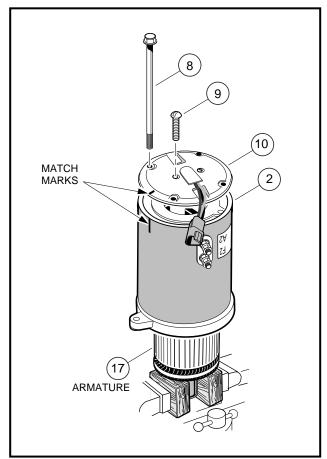


Figure 15-5 Lower Axle

Motor Disassembly

- 1. Before beginning disassembly, place match marks on the motor end shield and stator shell, then place the motor in a vice with wooden blocks as shown (Figure 15-6, Page 15-5).
- 2. Remove the four bolts (8) securing the end shield (10) to the stator shell (2) (Figure 15-6, Page 15-5).
- 3. Remove the two screws (9) attaching the end shield to the bearing retainer (Figure 15-6, Page 15-5).
- 4. Slide the armature (17) out of the opposite end of the stator shell (Figure 15-6, Page 15-5).



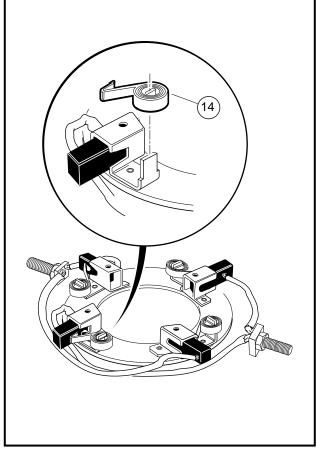


Figure 15-6 Motor Disassembly

Figure 15-7 Brush Spring Removal

- 5. Remove two screws (11) attaching brush rigging (12) to the stator shell (2) (Figure 15-11, Page 15-8).
- 6. Mark the brush terminal posts (A1 and A2) (13) to identify their positions in the stator shell and winding assembly, then remove the nuts (6) and flat washers (5) **(Figure 15-11, Page 15-8)**. From the outside, push the posts through the stator shell wall into the interior of the stator shell and winding assembly.
- 7. Carefully remove the brush rigging and the terminal posts from the stator shell.
- 8. To remove brush springs (14) from the rigging, lift the spring extensions out and over the brush mounts and then slide the springs off their mounting tabs (Figure 15-7, Page 15-5).

TESTING AND INSPECTING INDIVIDUAL COMPONENTS

Read DANGER and WARNING on page 15-1.

ARMATURE

- 1. Disassemble the motor and carefully inspect the armature for the following characteristics:
- Burned, charred or cracked insulation.
- Improperly cured varnish.
- Thrown solder.
- Flared armature windings.
- Damaged armature core laminations.
- Worn, burned or glazed commutators.

Armature, Continued:

- · Dirty or oily commutators.
- Raised commutator bars.
- Worn armature bearing or shaft.

A dirty or oily commutator should be cleaned and wiped dry. Abnormalities identified during the inspection can help determine original cause of failure. Slight roughness of the commutator can be polished smooth with 400 grit or finer sandpaper. See following CAUTION and NOTE.

CAUTION

 NEVER USE EMERY CLOTH TO POLISH THE COMMUTATOR. PARTICLES OF EMERY ARE CONDUCTIVE AND MAY SHORT-CIRCUIT THE COMMUTATOR BARS. NEVER USE OIL OR LUBRICANTS ON THE COMMUTATOR OR BRUSHES.

NOTE

• OIL ON THE COMMUTATOR MAY INDICATE A FAULTY TRANSAXLE INPUT SHAFT OIL SEAL.

Armature Ground Test

CAUTION

• DO NOT SUBMERGE THE ARMATURE IN SOLVENT.

NOTE

- BEFORE TESTING THE ARMATURE, WIPE IT CLEAN WITH A CLEAN CLOTH. REMOVE ANY CARBON DUST AND METAL PARTICLES FROM BETWEEN THE COMMUTATOR BARS.
- 1. With a multimeter set to 200 Ω (ohms), place one probe on the commutator and the other on the armature core. The multimeter should indicate no continuity (Figure 15-8, Page 15-6). If the reading is incorrect, replace the motor.

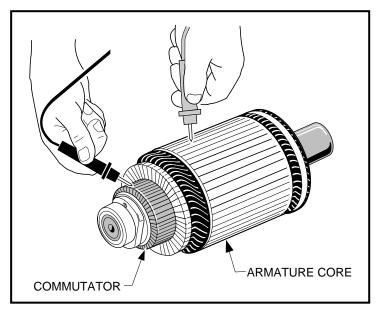


Figure 15-8 Armature

FIELD WINDINGS INSPECTION

Burned or scorched insulation on the field windings indicates the motor has overheated due to overloads or grounded or shorted coil windings. If the insulation on the field windings is scorched, replace the motor or the stator shell assembly.

MOTOR COMPONENTS

- 1. Inspect the insulators (4 and 7) for cracks or other damage (Figure 15-11, Page 15-8).
- 2. Inspect the brushes (13) for damage or excessive wear (Figure 15-11, Page 15-8). If brushes need to be replaced, see following NOTE.
- 3. Inspect the brush springs. Replace springs that are discolored from heat (light gold or blue tinted). Replace springs which apply a force of less than 16 oz. (Figure 15-9, Page 15-7).

A CAUTION

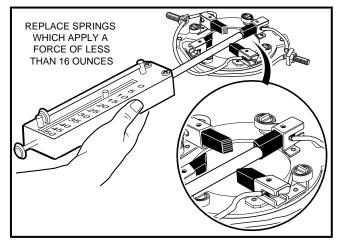
• WHEN CHECKING BRUSH SPRING TENSION, DO NOT OVER-EXTEND THE SPRING. USING EXCESSIVE FORCE WILL DAMAGE THE SPRING.

NOTE

- WHEN INSTALLING NEW BRUSHES, REMOVE AND REPLACE BRUSHES ONE AT A TIME. THIS METHOD ENSURES THE TERMINALS AND BRUSHES WILL BE PROPERLY POSITIONED IN THE RIGGING. **SEE PAGE 15-9** FOR BRUSH INSTALLATION.
- ALWAYS REPLACE ALL FOUR BRUSHES, NEVER REPLACE ONLY TWO.
- INSTALL THE BRUSHES IN THE SAME RIGGING 180° FROM EACH OTHER.

BEARING INSPECTION

- 1. Using a clean cloth, wipe the carbon dust off of the bearing. Inspect the bearing by spinning it by hand and checking for both axial (A) and radial (B) play (Figure 15-10, Page 15-7).
- 2. Replace the bearing if it is noisy, does not spin smoothly, or has excessive play. Check the bearing and replace if rusted, worn, cracked, or if there is an abnormal color change in the metal of the bearing. Do not remove the bearing unless it is to be replaced.





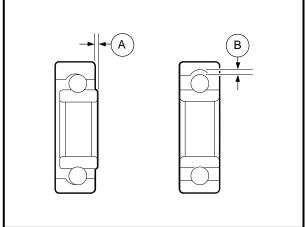


Figure 15-10 Inspect Bearing

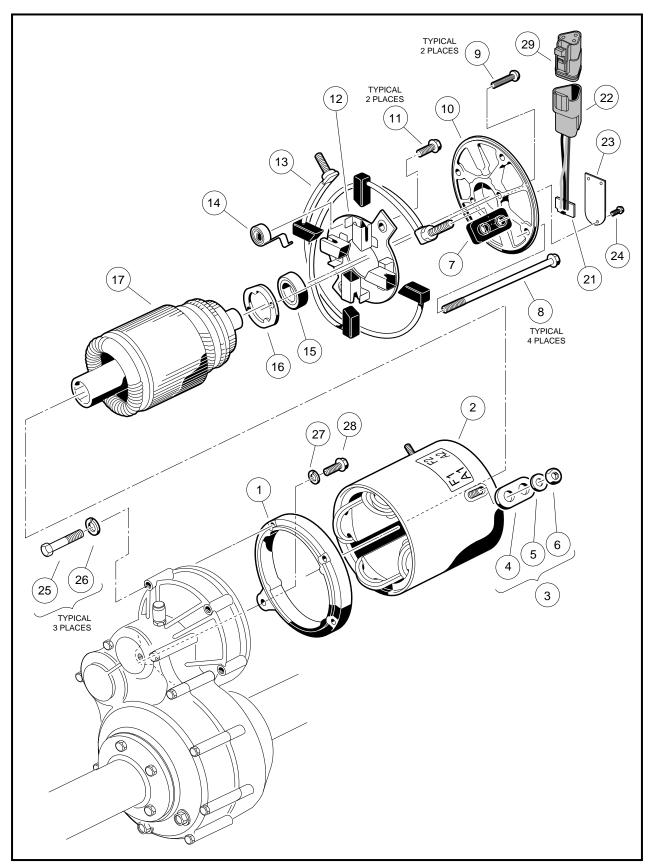


Figure 15-11 Motor

Page 15-8 2000 PowerDrive Plus Vehicle Maintenance and Service Supplement

BEARING REMOVAL

1. Place the wedge attachment tool (Club Car Part No. 1012812) between the bearing (15) and the armature (Figures 15-11 and 15-12, Pages 15-8 and 15-10). Make sure the wedge attachment tool is supporting the inner race of the bearing. If a press is not available, secure a bearing puller (Club Car Part No. 1012811) to the bearing and pull the bearing off of the end of the armature shaft. Support the shaft so it will not drop when the bearing is removed (Figure 15-12, Page 15-10). Discard the bearing.

BEARING INSTALLATION

1. Press new bearing onto armature. Use an arbor press that exerts pressure on inner race only. **See following NOTE**.

NOTE

- MAKE SURE THE BEARING RETAINER (16) (FIGURE 15-11, PAGE 15-8) IS POSITIONED ON THE ARMATURE SHAFT BEFORE THE BEARING IS PRESSED ON.
- AN ARBOR WITH AN OUTSIDE DIAMETER OF LESS THAN 5/8 INCH (16MM) SHOULD BE USED TO PRESS THE BEARING ON.

RECONDITIONING THE MOTOR

Read DANGER and WARNING on page 15-1.

Motor reconditioning must be performed by a qualified motor repair technician. The use of proper tools and procedures is absolutely essential for successful motor reconditioning.

Motor Specifications

Any rework must be performed by a qualified technician. Motor service specifications are listed in the table below.

ITEM	SERVICE LIMIT
Commutator diameter (minimum)	2.265 inches (66.675 mm)
Commutator concentric with armature shaft within	.001 inch (0.0508 mm)
Limit depth of cut when machining commutator	.005 inch (0.127 mm)
Bar to bar run out should not exceed	.0002 inch (.00508 mm)
If undercut of segment insulator is less than .016 inch (0.406 mm), it should be undercut to	.031 inch (0.8 mm)
Machined face of Commutator	8-16 micro inches
Field coil resistance (PowerDrive Plus 48 Volt, 3.20 Hp.)	1.32353 Ω (ohms)

MOTOR ASSEMBLY

Read DANGER and WARNING on page 15-1.

- 1. If the bearing has been removed, replace the bearing:
 - 1.1. Press new bearing onto armature. Use an arbor press that exerts pressure on inner race only. See NOTE following Bearing Installation on page 15-9.
- 2. Install the brushes. See NOTE on page 15-7.

Motor Assembly

Motor Assembly, Continued:

2.1. With brush rigging (12) facing down and held slightly above stator shell (2), insert the two terminal posts through insulators in stator shell wall at the A1 and A2 positions. Insert brush holder screws (11) through the rubber sealed holes in the rigging and into the threaded holes in the mounting bracket (Figure 15-11, Page 15-8). Tighten the screws to 20 in-lb (2.2 N-m). See also Figure 15-13, Page 15-12.

2.2. One at a time, push brush spring extensions back from brushes and slide brushes back until they are completely retracted into their mounting slots. Then position brush springs against sides of brushes so spring pressure will hold them in the retracted position (Figure 15-7, Page 15-5).

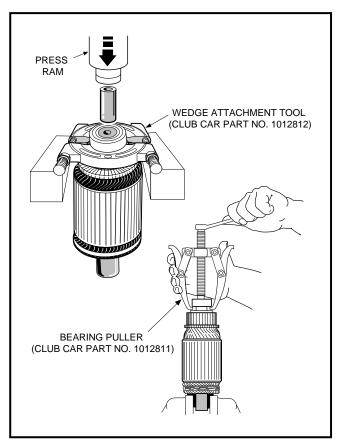


Figure 15-12 Bearing Removal

2.3. Slide the armature, bearing end first, into the stator shell. Make sure the brushes are held back while positioning the armature for proper commutator/brush contact. Release the brushes and place the springs outside the brushes so the brushes are being held against the commutator. See following CAUTION.

A CAUTION

- IF THE MOTOR IS BEING ASSEMBLED WITH THE ARMATURE STANDING ON END AS THE COMMUTATOR IS POSITIONED, MAKE SURE THE BRUSHES ARE HELD BACK. DO NOT ALLOW THE BRUSHES TO SUPPORT THE WEIGHT OF THE STATOR SHELL. THE BRUSHES CAN BE EASILY DAMAGED BY THIS WEIGHT.
- 3. Install end shield onto the stator shell.

3.1. Attach the end shield (10) to bearing retainer (16) by aligning the two holes in the bearing retainer with the two mating holes in the end shield and installing the screws (9) (Figure 15-11, Page 15-8). Tighten the screws to 17 in-lb (1.9 N-m). See following NOTE.

NOTE

- USE A LONG SCREW WITH SAME THREAD SPECIFICATIONS AS MOUNTING SCREWS TO MAINTAIN HOLE ALIGNMENT WHILE STARTING FIRST MOUNTING SCREW (FIGURE 15-14, PAGE 15-12).
 - 3.2. Align the match marks on the end shield and the stator shell, then install the four screws (8) **(Figure 15-11, Page 15-8)**. Tighten the screws to 90 in-lb (10 N-m).

NOTE

- MAKE SURE THE MOTOR SPEED SENSOR LEAD LOCATED ON THE END SHIELD IS ALIGNED WITH THE F2 AND A2 TERMINALS ON THE MOTOR HOUSING.
- 4. Make sure the armature turns freely. If it doesn't turn freely, disassemble the motor to find the problem. Make sure the bearing is properly seated in the end shield when assembling the motor.

MOTOR INSTALLATION

Read DANGER and WARNING on page 15-1.

- 1. Thoroughly clean any existing grease from the motor coupling spline and the transaxle input shaft using CRC[®] Brakleen[™] spray cleaner only.
- 2. Using a 1/4 inch wide flat-blade screwdriver, apply Nyogel PG-44A Damping Grease (Club Car part No. 102185301) to the transaxle input shaft splines, coating an area 1/4 to 3/8 inches wide from the tip end of the shaft. Be certain to fill all of the spline grooves within that area. Do not apply too much grease as this may cause difficulty when installing the motor.
- 3. Install the motor on the transaxle shaft, sliding it back and forth several times to distribute the lubricant.
- 4. Rotate the motor until the locating bolt mounting hole on the motor is aligned with its mounting hole in the transaxle case. Install the bolt (28) (thread in only a few turns) with lock washer (27) (Figure 15-11, Page 15-8). See also Figure 15-15, Page 15-13. Do not tighten the bolt at this time.
- 5. Install, but do not tighten the three 1/4-20 bolts (25) with lock washers (26) that mount the motor to the transaxle (Figure 15-11, Page 15-8). See following CAUTION.

A CAUTION

- MAKE SURE THE MOTOR IS PROPERLY SEATED IN THE TRANSAXLE HOUSING.
- 6. Finger tighten the four bolts, moving from bolt (C) to bolts (A, B, and D) until the motor is seated. With one wheel jacked up so it is off the ground, rotate the axle to make sure the motor is not binding on the transaxle input shaft (Figure 15-16, Page 15-13). See following NOTE.

NOTE

• FAILURE TO TIGHTEN THE MOTOR MOUNTING BOLTS TO THE PROPER TORQUE AND IN THE PROPER SEQUENCE CAN RESULT IN MOTOR NOISE DURING OPERATION.

MOTOR Motor Installation

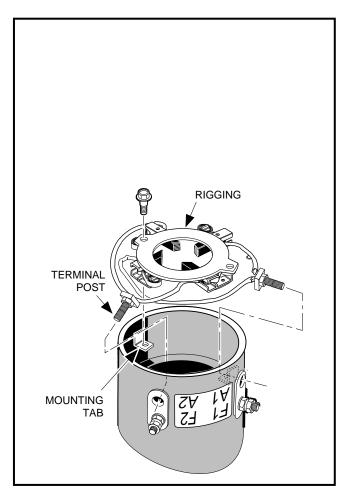
Motor Installation, Continued:

7. Tighten lower 1/4 inch bolt (C). Next, tighten bolt (A), then tighten center bolt (B) at the top. Tighten bolts to 65 in-lb (7.3 N-m). Tighten the 5/16 inch bolt (D) to 155 in-lb (17.5 N-m) (Figure 15-16, Page 15-13).

8. Install the motor wires. Make sure they are connected to the correct terminals. Tighten the terminal retaining nuts to 65 in-lb (7.3 N-m). **See following NOTE.**

NOTE

- IF MOTOR WIRES WERE NOT TAGGED FOR IDENTIFICATION BEFORE BEING DISCONNECTED, SEE WIRING DIAGRAM, **SECTION 11**, **FIGURE FIGURE 11-3**, **PAGE 11-4**.
- 9. If using a chain hoist, lower the vehicle and guide the leaf springs into the shackles. If using a floor jack, raise the transaxle until the leaf springs can be guided into the shackles.
- 10. Insert mounting bolts through spring shackles and bushings in leaf spring eyes and install lock nuts. Tighten bolts to 23 ft-lb (31 N-m). See Section 9–Rear Suspension in the Maintenance and Service Manual.



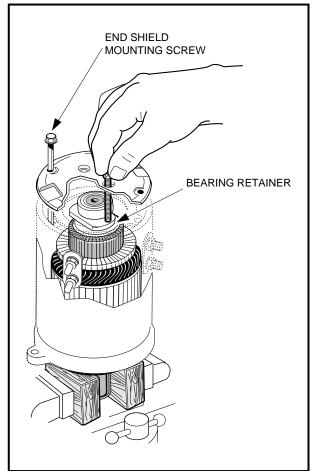
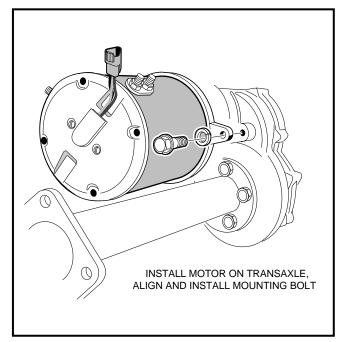


Figure 15-13 Brush Installation

Figure 15-14 End Shield Installation

- 11. Install the shock absorbers. Tighten nut until rubber bushing expands to the size of the cup washer.
- 12. If removed, reinstall wheels and finger-tighten the lug nuts.
- 13. Lift vehicle and remove jackstands. Lower vehicle to the floor and tighten (using a crisscross pattern) to 55 ft-lb (74.6 N-m).

MOTOR Motor Installation 15



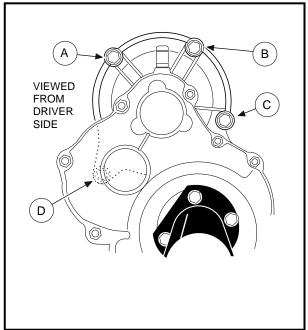


Figure 15-15 Motor Installation

Figure 15-16 Motor Mount

14. Connect the battery cables (positive cable first) and tighten to 110 in-lb (12.4 N-m) (Figure 15-1, Page 15-2). Coat terminals with Batter Protector Spray (Club Car Part No. 1014305) to minimize corrosion. Place Tow switch in the RUN position.

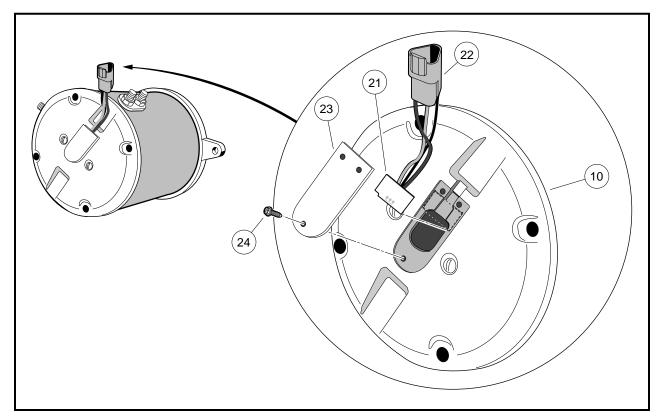


Figure 15-17 Installing the Motor Speed Sensor

MOTOR Motor Speed Sensor

MOTOR SPEED SENSOR

Read DANGER and WARNING on page 15-1.

Testing the Motor Speed Sensor

See Test Procedure 14, Section 11, Page 11-22.

Motor Speed Sensor Removal

- 1. Place Tow/Run switch in the TOW position and disconnect battery cables (Figure 15-1, Page 15-2).
- 2. Disconnect the three-pin connector (22) (Figure 15-17, Page 15-13).
- 3. Remove the three retaining screws (24) from the retaining plate (23) located on the motor end shield (10) (Figure 15-17, Page 15-13).
- 4. Remove motor speed sensor (21) from recessed area on motor (Figure 15-17, Page 15-13).

Motor Speed Sensor Installation

- Position the motor speed sensor (21) in the recessed area on the motor. Sensor should fit flush against the motor (Figure 15-17, Page 15-13).
- 2. Position retaining plate (23) over motor speed sensor and align the three retaining plate holes with motor end shield holes. Install three retaining screws (24) (Figure 15-17, Page 15-13).
- 3. Reconnect the three-pin connector (22) (Figure 15-17, Page 15-13).
- Reconnect battery cables (positive cable first) and tighten to 110 in-lb (12.4 N-m). Coat terminals with Batter Protector Spray (Club Car Part No. 1014305) to minimize corrosion. Place Tow/Run switch in the RUN position (Figure 15-1, Page 15-2).

SECTION 16-TRANSAXLE

A DANGER

- BATTERY EXPLOSIVE GASES! DO NOT SMOKE. KEEP SPARKS AND FLAMES AWAY. VENTILATE WHEN CHARGING OR USING IN AN ENCLOSED SPACE. ALWAYS WEAR FULL FACE SHIELD AND RUBBER GLOVES WHEN WORKING ON OR NEAR BATTERIES.
- USE EXTREME CAUTION WHEN USING TOOLS, WIRES, OR METAL OBJECTS NEAR BATTERIES! A SHORT CIRCUIT AND (OR) SPARK COULD CAUSE AN EXPLOSION.
- BATTERY POISON! CONTAINS ACID! CAUSES SEVERE BURNS. AVOID CONTACT WITH SKIN, EYES, OR CLOTHING. ANTIDOTES:
 - EXTERNAL: FLUSH WITH WATER. CALL A PHYSICIAN IMMEDIATELY.
 - INTERNAL: DRINK LARGE QUANTITIES OF MILK OR WATER. FOLLOW WITH MILK OF MAGNESIA OR VEGETABLE OIL. CALL A PHYSICIAN IMMEDIATELY.
 - EYES: FLUSH WITH WATER FOR FIFTEEN MINUTES. CALL PHYSICIAN IMMEDIATELY.

A WARNING

- ONLY TRAINED TECHNICIANS SHOULD REPAIR OR SERVICE THIS VEHICLE. ANYONE DOING EVEN SIMPLE REPAIRS OR SERVICE SHOULD HAVE KNOWLEDGE AND EXPERIENCE IN ELECTRICAL AND MECHANICAL REPAIR.
- FOLLOW ALL PROCEDURES EXACTLY AS STATED IN THIS MANUAL, AND HEED ALL DANGER, WARNING AND CAUTION STATEMENTS, AS WELL AS THOSE AFFIXED TO THE VEHICLE.
- WEAR SAFETY GLASSES OR APPROVED EYE PROTECTION WHILE SERVICING VEHICLE.
- TURN KEY SWITCH **OFF**, PLACE FORWARD/REVERSE HANDLE IN THE **NEUTRAL** POSITION, AND REMOVE KEY BEFORE SERVICING THE VEHICLE.
- MOVING PARTS! DO NOT ATTEMPT TO SERVICE THE VEHICLE WHILE IT IS RUNNING.
- USE INSULATED TOOLS WHEN WORKING NEAR BATTERIES OR ELECTRICAL CONNECTIONS. USE EXTREME CAUTION TO AVOID SHORTING OF COMPONENTS OR WIRING.
- LIFT ONLY ONE END OF THE VEHICLE AT A TIME. BEFORE LIFTING, LOCK THE BRAKES AND CHOCK THE WHEELS THAT REMAIN ON THE FLOOR. USE A SUITABLE LIFTING DEVICE (CHAIN HOIST OR HYDRAULIC FLOOR JACK) WITH 1000 LB. (454 KG.) MINIMUM LIFTING CAPACITY. DO NOT USE LIFTING DEVICE TO HOLD VEHICLE IN RAISED POSITION. ALWAYS USE APPROVED JACKSTANDS OF PROPER WEIGHT CAPACITY TO SUPPORT THE VEHICLE.
- TO AVOID UNINTENTIONALLY STARTING VEHICLE, PLACE TWO SWITCH IN **TOW**, THEN DISCONNECT BATTERIES AS SHOWN IN **SECTION 10**, **FIGURE 10-1**, **PAGE 10-2** AND DISCHARGE THE CONTROLLER AS FOLLOWS:
 - TURN KEY SWITCH ON, PLACE FORWARD/REVERSE ROCKER SWITCH IN REVERSE.
 - SLOWLY DEPRESS THE ACCELERATOR PEDAL AND KEEP IT DEPRESSED UNTIL THE REVERSE WARNING BUZZER CAN NO LONGER BE HEARD. WHEN THE BUZZER STOPS SOUNDING, THE CONTROLLER IS DISCHARGED.

GENERAL INFORMATION

There are two types of transaxles used in the manufacture of the electric vehicle. The different transaxles are identified by the orientation of the gear case bolt heads. The Type G transaxle has gear case bolt heads oriented toward the passenger side of the vehicle. The Type K transaxle has gear case bolt heads oriented toward the driver side of the vehicle. Please note that parts used in these transaxles are not interchangeable with one another. Service and repair procedures specific to each transaxle are noted throughout this section.

6 TRANSAXLE Lubrication

LUBRICATION

There are two plugs located on the lower half of the transaxle housing. The upper plug (as viewed when the vehicle is on a level surface), is used as a lubricant level indicator. When the vehicle is parked on a level surface, the lubricant level should be even with the bottom of the hole. The lower plug is for draining the lubricant. When draining the lubricant, the upper plug should be removed so the lubricant will drain faster. Be sure the drain plug is reinstalled before filling.

NOTE

 RECYCLE OR DISPOSE OF USED OIL OR LUBRICANT IN ACCORDANCE WITH LOCAL, STATE AND FEDERAL REGULATIONS.

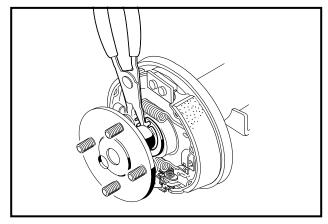
AXLE BEARING AND SHAFT

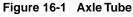
Read DANGER and WARNING on page 16-1.

AXLE SHAFT

Axle Shaft and Oil Seal Removal

- 1. Place chocks at the front wheels. Loosen lug nuts on rear wheels and lift the rear of the vehicle with a chain hoist or floor jack. Place jackstands under the axle tubes to support the vehicle.
- 2. Remove the rear wheel and brake drum. See Section 6-Wheel Brake Assemblies and Section 8-Wheels and Tires in the appropriate Maintenance and Service Manual.
- 3. Using 90° internal snap ring pliers, remove the internal retaining ring (6) from the axle tube (Figures 16-3 or 16-4, Pages 16-3 or 16-4). See also Figure 16-1, Page 16-2.
- 4. Remove the axle, retaining ring, and bearing assembly by pulling the axle straight out of the housing.





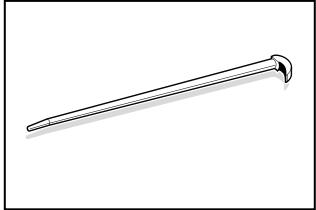


Figure 16-2 Rolling Wedge Bar

5. Use a 16 inch (40 cm) rolling wedge bar (Figure 16-2, Page 16-2) to remove oil seal. Insert wedge bar underneath the seal lip and pry out oil seal (17) (Figure 16-5, Page 16-5). See following CAUTION.

A CAUTION

 DO NOT SCAR OR DAMAGE THE INSIDE SURFACES OF THE TUBE WHEN REMOVING THE OIL SEAL. A DAMAGED TUBE MIGHT HAVE TO BE REPLACED.

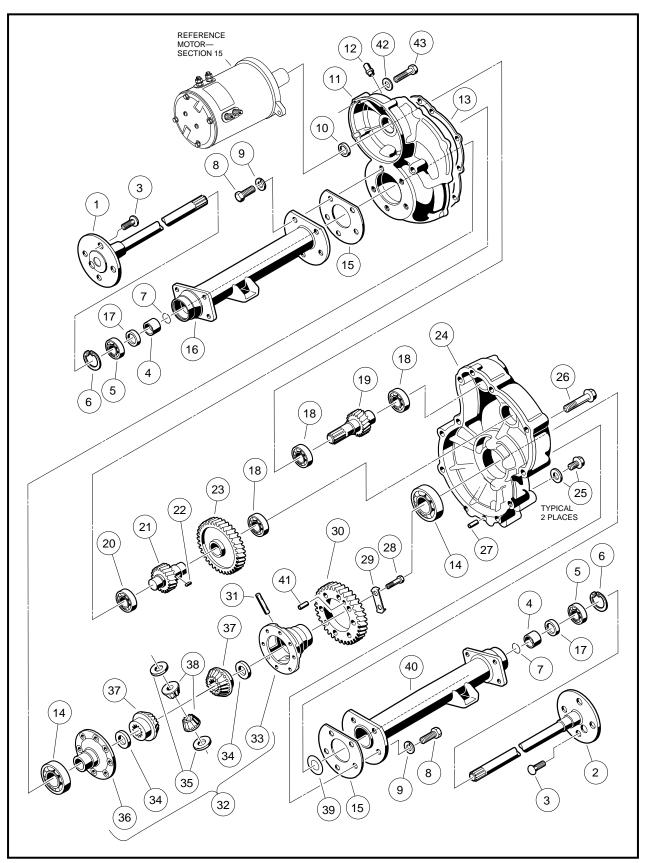


Figure 16-3 Transaxle - Type K

16 TRANSAXLE Axle Bearing and Shaft

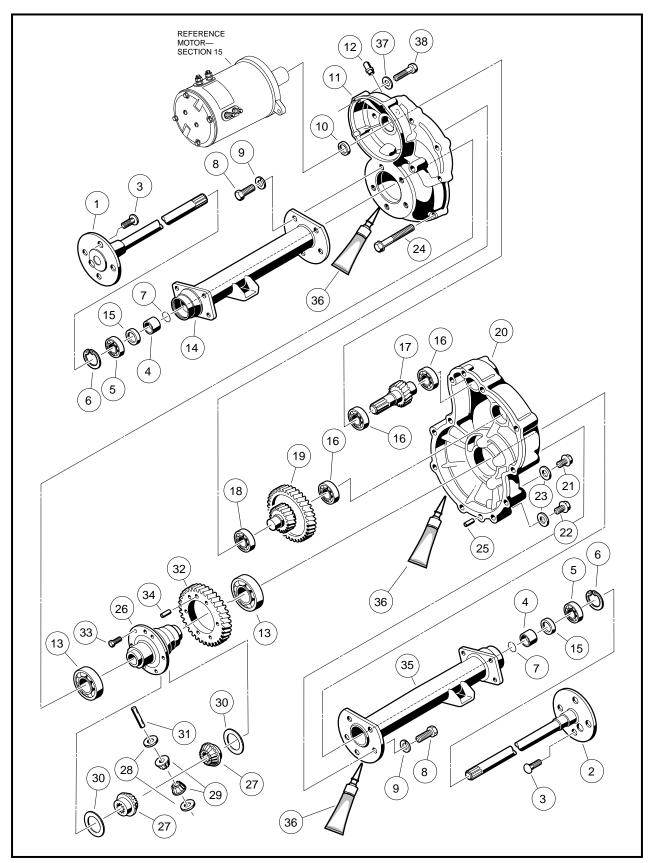


Figure 16-4 Transaxle - Type G

- 6. Inspect the axle shaft assembly to be sure the bearing and collar have not slipped and are still seated against the shoulder on the axle shaft.
- 7. Inspect bearing (5) (Figure 16-3, Page 16-3 or Figure 16-4, Page 16-4). If the bearing in a Type K transaxle is worn or damaged, replace bearing. If the bearing in a Type G transaxle is worn or damaged, see NOTE at Axle Bearing on Page 16-5.

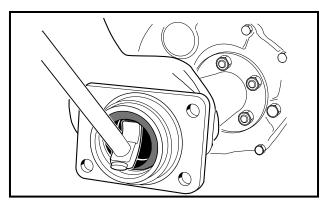


Figure 16-5 Seal Lip

AXLE BEARING

NOTE

 DO NOT REMOVE AXLE BEARING FROM A TYPE G TRANSAXLE. IF BEARING IS WORN OR DAMAGED, THE ENTIRE AXLE ASSEMBLY (1 OR 2) MUST BE REPLACED (FIGURE 16-4, PAGE 16-4).

Axle Bearing Removal (Type K Transaxle Only)

- 1. Remove the retaining ring (7) from the axle shaft (Figure 16-3, Page 16-3).
- 2. Place a bearing puller wedge attachment (Club Car Part No. 1012812) on the axle shaft between the wheel mounting flange and the bearing.
- 3. Press bearing (5) and collar (4) off together (Figure 16-6, Page 16-6).

A CAUTION

DO NOT TIGHTEN THE BEARING PULLER WEDGE ATTACHMENT AGAINST THE AXLE SHAFT.
 THIS COULD DAMAGE THE AXLE SHAFT WHEN PRESSING OFF THE BEARING AND COLLAR.

NOTE

IT MAY BE NECESSARY TO HEAT THE COLLAR BEFORE THE COLLAR CAN BE REMOVED.

Axle Bearing Installation (Type K Transaxles Only)

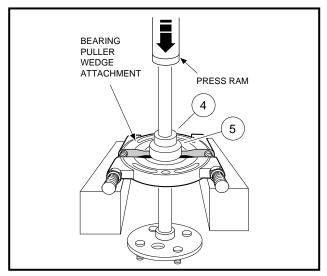
- 1. If removed, place retaining ring (6) on axle shaft (1 or 2) (Figure 16-3, Page 16-3). The retaining ring will be loose on the axle shaft until it is installed into the axle tube.
- 2. Apply two drops of Loctite[®] 271 to the inside of the collar.

16 TRANSAXLE Axle Bearing and Shaft

Axle Bearing Installation (Type K Transaxles Only), Continued:

A CAUTION

- APPLY LOCTITE[®] 271 TO INSIDE OF COLLAR ONLY, NOT TO THE SHAFT, SO THE LOCTITE WILL BE PUSHED AWAY FROM THE BEARING AS THE COLLAR AND BEARING ARE PRESSED ON. IF LOCTITE GETS ON OR IN THE BEARING, THE BEARING MUST BE REPLACED.
- THE COLLAR SHOULD BE REMOVED NO MORE THAN TWO TIMES. IF A BEARING IS REMOVED A THIRD TIME, THE SHAFT AND COLLAR WILL NOT GIVE A PROPER FIT.



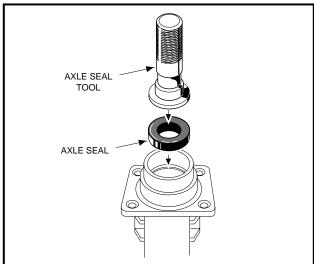


Figure 16-6 Bearing and Collar

Figure 16-7 Axle Seal Tool

3. Place the bearing and the collar on the shaft (note, this is a sealed bearing). See following CAUTION.

A CAUTION

- IF THE BEARING WAS REMOVED FROM THE SHAFT, REPLACE BEARING WITH A NEW ONE.
- 4. Place the bearing puller wedge attachment against the collar and press on both the bearing and collar. **See CAUTION on page 16-5.**
- 5. Install retaining ring (7) into the groove on the axle shaft (Figure 16-3, Page 16-3).

Axle Shaft and Oil Seal Installation

- 1. Clean bearing and seal seats in the axle tube (16 or 40) (Figure 16-3, Page 16-3) or (14 or 35) (Figure 16-4, Page 16-4).
- 2. Place a new seal (17) (Figure 16-3) or (15) (Figure 16-4) in the axle tube with the seal lip facing away from the bearing. Use an axle seal tool (Club Car Part No. 1014162) and mallet to tap it in until it seats firmly in position (Figure 16-7, Page 16-6). A hydraulic press may also be used with the axle seal tool.
- 3. Clean the shaft splines and then insert the shaft, splined end first, through the seal and into the axle tube. Be careful not to damage the seal. Then advance the shaft through the inner bearing and rotate it to align the shaft splines with the splined bore of the differential side gear. Continue advancing the shaft until the bearing seats against the axle tube shoulder.
- 4. Using snap ring pliers, install retaining ring (6) inside axle tube (Figure 16-3 or 16-4, Pages 16-3 or 16-4). See following NOTE.

NOTE

• TYPE G TRANSAXLES: IF RETAINING RING (6) MUST BE REPLACED, THE ENTIRE AXLE SHAFT ASSEMBLY (1 OR 2) MUST BE REPLACED (FIGURE 16-4, PAGE 16-4).

5. Place a 1/4 inch to 3/8 inch (6 to 10 mm) diameter rod against the retaining ring and tap lightly at four to five locations around the retaining ring to ensure it is properly seated. **See following WARNING.**

WARNING

 BE SURE THE RETAINING RING IS PROPERLY SEATED IN ITS GROOVE. IF THE RING IS NOT PROPERLY INSTALLED, THE AXLE ASSEMBLY WILL SEPARATE FROM THE TRANSAXLE AND DAMAGE THE AXLE ASSEMBLY AND OTHER COMPONENTS. LOSS OF VEHICLE CONTROL COULD RESULT, CAUSING SEVERE PERSONAL INJURY.

TRANSAXLE

Read DANGER and WARNING on page 16-1.

TRANSAXLE REMOVAL

- 1. Place chocks at the front wheels and slightly loosen the lug nuts on both rear wheels.
- Place floor jack under transaxle and raise rear of vehicle (Figure 16-8, Page 16-7) then place jackstands under frame cross-member between the spring mount and the side stringer, just forward of each rear wheel. Lower the vehicle to let the jackstands support the vehicle.
- 3. Remove the rear wheels, then thread one lug nut onto a stud on each rear hub. This will keep the brake drums on the hubs.
- 4. Remove the cotter pins (1), brake cable clevis pins (2), and cable retaining E-clips (3). Disconnect the brake cables (4) (Figure 16-9, Page 16-7).
- 5. Disconnect the shock absorbers from their lower mounts (Figure 16-10, Page 16-8).

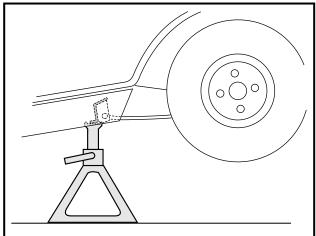


Figure 16-8 Support Vehicle on Jackstands

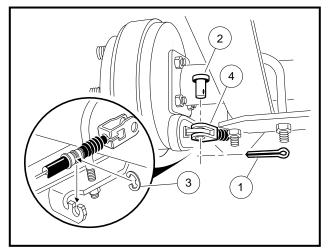
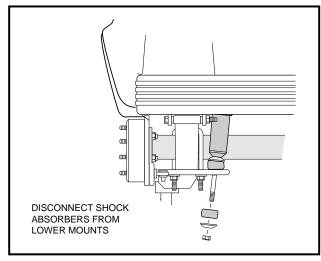


Figure 16-9 Disconnect Brakes

- 6. Disconnect the four motor wires. Use two wrenches to prevent the post from turning.
- 7. With a floor jack supporting the transaxle, remove lower spring shackle nuts and bolts. Position shackles so they are clear of springs (Figure 16-11, Page 16-8).

TRANSAXLE Transaxle



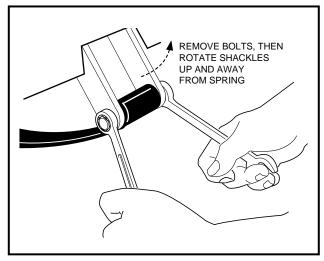


Figure 16-10 Disconnect Shocks

Figure 16-11 Shackles

- 8. If a chain hoist was used to raise the vehicle, lift the vehicle high enough to permit easy access and clearance for removal of the motor. If a floor jack was used to raise the vehicle, lower the transaxle enough to permit easy access and clearance for removal of the motor.
- 9. Remove the three motor mounting bolts (Figure 16-13, Page 16-8), and the motor positioning bolt (Figure 16-14, Page 16-9) mounting the motor to the transaxle. See following WARNING.

A WARNING

DO NOT POSITION FINGERS UNDER MOTOR WHEN SLIDING OFF INPUT SHAFT IN STEP 9.
 FINGERS MAY GET PINCHED WHEN MOTOR DISENGAGES.

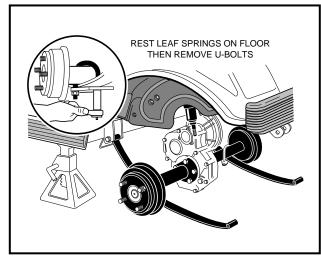


Figure 16-12 Leaf Springs

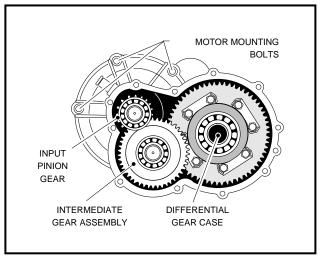


Figure 16-13 Motor Mounting Bolts

- 10. Carefully remove the motor from the transaxle. Slide the motor away from the transaxle until the motor spline becomes disengaged from the input shaft, then lift motor out. **See preceding WARNING.**
- 11. If a floorjack was used, pull floorjack from beneath the transaxle and allow the springs to rest on the floor.

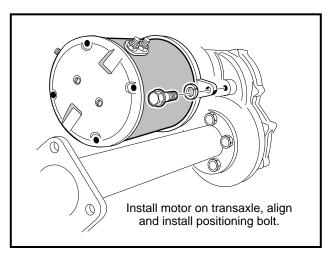


Figure 16-14 Motor Positioning Bolt

- 12. Remove the U-bolts attaching the transaxle to the leaf springs (Figure 16-12, Page 16-8).
- 13. Carefully lift each end of the transaxle off its positioning pin (on the leaf spring) and slide the transaxle to the rear and out of the vehicle.
- 14. Drain the lubricant from the transaxle and remove the axle shafts as instructed on page 16-2. **See also NOTE on page 16-2.**
- 15. If removal of the brake assemblies is required, see Section 6–Wheel Brake Assemblies in the Maintenance and Service Manual.

TRANSAXLE DISASSEMBLY, INSPECTION AND ASSEMBLY

Read DANGER and WARNING on page 16-1.

TRANSAXLE DISASSEMBLY AND INSPECTION

1. To detach axle tubes (16 and 40) (Figure 16-3, Page 16-3) or (14 and 35) (Figure 16-4, Page 16-4) from the transaxle housing, remove the bolts and lock washers (8 and 9) (Figure 16-3 or 16-4).

NOTE

- TYPE K TRANSAXLES ONLY: SHIMS ARE LOCATED BETWEEN AXLE TUBE AND DIFFERENTIAL CASE BEARING. DO NOT DAMAGE SHIMS. IF SHIMS ARE REMOVED, SET THEM ASIDE FOR REINSTALLATION.
- 2. Remove 10 bolts (26) (Figure 16-3, Page 16-3) or 11 bolts, (24) (Figure 16-4, Page 16-4) that hold housing together.
- 3. Pull the halves of the housing apart. If necessary, tap lightly on the spline of the input pinion.

A CAUTION

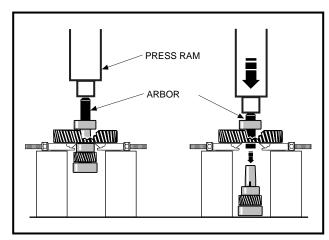
• TO PREVENT DAMAGE TO THE HOUSING MATING SEAL SURFACES, USE CAUTION WHEN SEPARATING HALVES.

Transaxle Disassembly and Inspection, Continued:

4. Remove input pinion gear by pulling gear (19) (Figure 16-3, Page 16-3) or (17) (Figure 16-4, Page 16-4) out while rocking intermediate gear assembly. Lift intermediate gear assembly and differential gear case unit out simultaneously.

A CAUTION

DO NOT DAMAGE GEARS. USE EXTREME CARE WHEN HANDLING THEM.



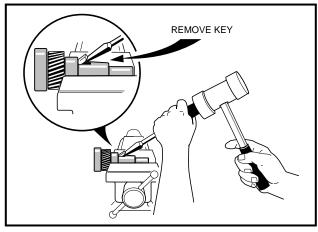


Figure 16-15 Intermediate Gear Assembly

Figure 16-16 Remove Key

5. Use a bearing puller or arbor press to remove bearings (18) (Figure 16-3, Page 16-3) or (16) (Figure 16-4, Page 16-4) from the input pinion gear. If the oil seal (10) is damaged, replace it (Figures 16-3 or 16-4, Pages 16-3 or 16-4). See also Figure 16-15, Page 16-10. See following CAUTION.

A CAUTION

- DO NOT REUSE BEARINGS AFTER REMOVING THEM. REPLACE BEARINGS WITH NEW ONES.
- 6. To disassemble the intermediate gear assembly, press off together the bearing (18) (Figure 16-3, Page 16-3) or (16) (Figure 16-4, Page 16-4) and the gear (23) (Figure 16-3, Page 16-3) or (19) (Figure 16-4, Page 16-4). See also Figure 16-15, Page 16-10.

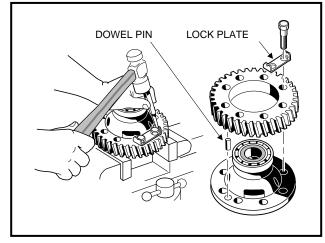


Figure 16-17 Lock Plate (Type K Only)

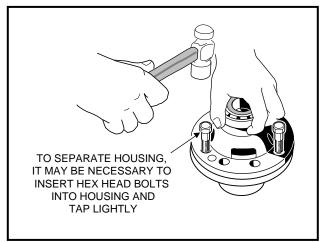
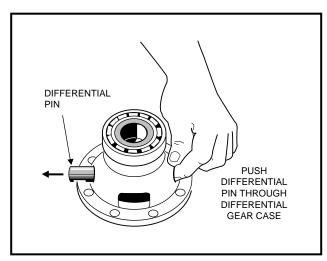


Figure 16-18 Separate Housing

- 7. Type K transaxles: Remove key (22) (Figure 16-3, Page 16-3). See also Figure 16-16, Page 16-10.
- 8. Press the bearing (20) (Figure 16-3, Page 16-3) or (18) (Figure 16-4, Page 16-4) off the intermediate gear assembly.
- 9. Disassemble the differential gear case:
 - 9.1. **Type K transaxles:** Bend the bolt lock plates (29) down onto the ring gear (30) **(Figure 16-3, Page 16-3).** See also Figure 16-17, Page 16-10.
 - 9.2. Remove eight hex bolts (28) **(Figure 16-3, Page 16-3)** or four hex bolts, (33) **(Figure 16-4, Page 16-4)**, that secure the ring gear to the differential case.
 - 9.3. Remove the ring gear. Retain dowel pin from between ring gear and differential case for reassembly.
 - 9.4. Separate the differential gear case housing. If necessary, reinstall two of the hex bolts (removed previously in step 9.2.) into the differential gear unit and, while holding the unit slightly above the work area, lightly tap the bolt heads (**Figure 16-18**, **Page 16-10**). Remove the two bolts.
 - 9.5. Remove the differential pin (31) by pushing pin through differential gear case from one side (Figures 16-3 or 16-4, Pages 16-3 or 16-4). See also Figure 16-19, Page 16-11.



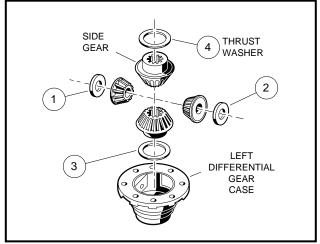


Figure 16-19 Differential Pin

Figure 16-20 Left Differential

- 9.6. Remove the idler gears and thrust plates (38 and 35), (Figure 16-3, Page 16-3) or (29 and 28) Figure 16-4, Page 16-4).
- 9.7. Remove the differential gears and thrust plates (34 and 37) (Figure 16-3, Page 16-3) or (30 and 27) (Figure 16-4, Page 16-4). See also Figure 16-20, Page 16-11.
- 9.8. Inspect the bearings (14) (Figure 16-3, Page 16-3) or (13) (Figure 16-4, Page 16-4) of the differential case and replace them if they are damaged. To remove them, press them off. See CAUTION at bottom of page 16-10.
- Inspect parts for wear or damage. Any worn or damaged parts should be replaced. See following NOTE.

NOTE

DAMAGED OR WORN GEARS SHOULD BE REPLACED AS SETS.

TRANSAXLE ASSEMBLY

A CAUTION

- DO NOT PRESS AGAINST THE BEARING OUTER RACE.
- TYPE K TRANSAXLES: GASKET (13) FACES OF THE HOUSING MUST BE CLEAN AND SMOOTH. USE ONLY A NEW GASKET THAT IS NOT TORN OR DAMAGED. THE GASKET MUST LIE FLAT AGAINST THE HOUSING FACES (FIGURE 16-3, PAGE 16-3).
- THE HOUSING AND ALL PARTS MUST BE WIPED CLEAN AND DRY BEFORE REASSEMBLY.
- 1. If bearings (14) (Figure 16-3, Page 16-3) or (13) (Figure 16-4, Page 16-4) were removed during disassembly, install new bearings using an arbor press.
- 2. Assemble the differential gear case.
 - 2.1. Install the pin (31) (Figures 16-3 or 16-4, Pages 16-3 or 16-4). Apply a small amount of oil to all thrust plates and to both ends of the pin.

• Type K transaxles:

- 2.2. While aligning the dowel pin, assemble the two halves of the differential gear case (33 and 36) and reinstall the output gear (30) (Figure 16-3, Page 16-3).
- 2.3. Install eight hex bolts (28) and the bolt lock plates (29) (Figure 16-3, Page 16-3). Tighten the bolts to 18 ft-lb (24 N-m).
- 2.4. Bend the edges of the bolt locking tabs securely against the flats of the bolt heads to prevent the bolts from loosening and possibly causing damage (Figure 16-17, Page 16-10).
- 2.5. If the large gear (23) was removed from the intermediate gear, insert key (22) into keyway in the shaft and then press the large gear and the bearing (18) onto the shaft. Be sure the key is properly positioned in the keyway before attempting to press on the large gear and bearing (Figure 16-3, Page 16-3).

Type G transaxles:

2.6. Install four hex bolts (33) and output gear (32). Tighten bolts to 51 ft-lb (69 N-m) (Figure 16-4, Page 16-4).

All transaxles:

- 3. Press a new bearing (20) (Figure 16-3, Page 16-3) or (18) (Figure 16-4, Page 16-4) onto the intermediate gear assembly.
- 4. Press new bearing (18) (Figure 16-3, Page 16-3) or (16) (Figure 16-4, Page 16-4) onto input pinion gear.
- 5. Apply grease to the lip of the new oil seal (10) (Figures 16-3 or 16-4, Pages 16-3 or 16-4) and install the seal using a transaxle pinion seal tool (Club Car Part No. 1014161). The lip of the oil seal should face the inside of the transaxle housing. Make sure the seal is firmly seated.
- 6. Install the differential assembly, the intermediate gear assembly, and the input pinion gear simultaneously. Be sure all bearings are seated properly in the housing. Rotate the input shaft to check for smooth gear operation (Figure 16-13, Page 16-8).
- 7. Install both dowel pins (27) (Figure 16-3, Page 16-3) or (25) (Figure 16-4, Page 16-4) in the transaxle housing (24 or 20).
- 8. Install left half of transaxle housing:

For Type K transaxles:

- 8.1. Place a new gasket (13) **(Figure 16-3, Page 16-3)** in position on the mating face of the housing. Use the dowel pins to position the gasket. Make sure all holes are aligned.
- 8.2. Install left half of transaxle housing (24) (Figure 16-3, Page 16-3).
- 8.3. Install the ten bolts (26) and tighten to 69 in-lb (7.8 N-m) (Figure 16-3, Page 16-3).

8.4. If the axle tube (16 and 40) was removed, install the shims (39), (if the shims were removed) and a new gasket. Install the axle tube with five lock washers and bolts (9 and 8) (Figure 16-3, Page 16-3). Tighten the bolts to 22 ft. lb (30 N-m).

NOTE

• TYPE K TRANSAXLES: IF THE DIFFERENTIAL CASE (33 AND 36), THE TRANSAXLE HOUSING (11 AND 24) OR AXLE TUBE (16 AND 40) (FIGURE 16-3, PAGE 16-3) WAS REPLACED, SEE SHIMMING THE TRANSAXLE ON PAGE 16-13.

• For Type G transaxles:

8.1. Place 1/8 inch bead of three bond liquid gasket on mating face of housing. See following NOTE.

NOTE

- TYPE G TRANSAXLES DO NOT USE A GASKET ON THE MATING FACE OF THE HOUSING. USE AN 1/8 INCH BEAD OF THREE BOND LIQUID GASKET INSTEAD.
 - 8.2. Install left half of transaxle housing (20) (Figure 16-4, Page 16-4).
 - 8.3. Install eleven bolts in the case housing and tighten to 19 ft-lb (25.7 N-m). Type G transaxles have no shims or gasket.
 - 8.4. Install axle tube with lock washers and bolts (9 and 8) (Figure 16-4, Page 16-4). Tighten the bolts to 36 ft-lb (49 N-m).

· For all transaxles:

- 9. Install the brake assemblies as instructed in Section 6-Wheel Brake Assemblies.
- 10. Apply a small amount of grease to the lip of the oil seal (17) (Figure 16-3, Page 16-3) or (15) (Figure 16-4, Page 16-4).
- 11. Clean the splines on the axle shaft (1 and 2). Rotate the axle to align the shaft splines with the splined bore of the differential side gear. Push the shaft in until the bearing seats against the shoulder in the axle tube (Figures 16-3 and 16-4, Pages 16-3 and 16-4).
- 12. Install the retaining ring (6) (Figures 16-3 and 16-4, Pages 16-3 and 16-4) in the axle tube. See WARNING on page 16-7.
- 13. Make sure the drain plug is installed in the transaxle and tightened to 23 ft-lb (31 N-m). Fill the transaxle, through the level indicator hole, with 22 ounces of SAE 30 API Class SE, SF, or SG oil (a higher grade may also be used). Install and tighten the level indicator plug to 23 ft-lb (31 N-m).

SHIMMING THE TRANSAXLE

Type K Transaxles Only

If the differential case (36 and 33), transaxle housing (11 and 24), or axle tube (16 and 40) has been replaced, the transaxle may need new shims. To determine whether new shims are necessary, the transaxle must be completely assembled except for the short axle tube (16) and both axle shafts (1 and 2) (Figure 16-3, Page 16-3).

- 1. Stand the transaxle on end, on the axle tube.
- 2. Using a depth gauge, measure the distance from the gasket seal surface of the axle tube (gasket must be removed) to the outer race of the bearing (14) on the differential case assembly (32) (Figure 16-3, Page 16-3) See also Figure 16-21, Page 16-14.
- 3. Use the following charts to determine whether shimming is required and, if so, how many shims (Club Car Part No. 1013781) should be used.

TRANSAXLE Transaxle Installation

Distance from gasket seal surface to outer race or bearing - INCHES (MM)	SHIMS REQUIRED
Up to .134 inches (3.4 mm)	0
.134142 inches (3.4 - 3.6 mm)	1
.142150 inches (3.6 - 3.8 mm)	2
.150155 inches (3.8 - 3.9 mm)	3

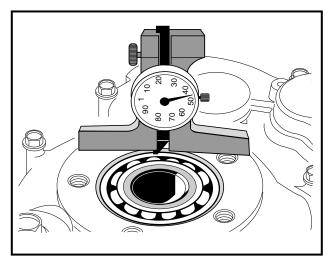


Figure 16-21 Depth Gauge

TRANSAXLE INSTALLATION

See DANGER and WARNING on page 16-1.

- 1. If using a chain hoist, raise the vehicle and place transaxle in position on the jackstands. If using a floor jack, lower the jackstands to their lowest settings and place the transaxle in position on the jackstands.
- 2. Align the center hole in the saddle of the transaxle with the pilot bolt in the leaf spring assembly.
- 3. Install the two U-bolts, lockwashers, and nuts. Tighten the nuts to 25 ft-lb (34 N-m). Tighten the U-bolt nuts so an equal amount of thread is visible on each leg of the bolt.
- 4. Install the motor. See Section 15-Motor.
- 5. If using a chain hoist, lower the vehicle while guiding the leaf springs into the rear spring shackles. If using a floor jack, raise the differential while guiding the leaf springs into the rear spring shackles. Then raise the jackstands to support the transaxle.
- 6. Reconnect the four motor wires. Tighten the retaining nuts to 65 in-lb (7.3 N-m). Use two wrenches to prevent the motor posts from turning. **See following NOTE.**

NOTE

- IF THE MOTOR WIRES WERE NOT TAGGED WHEN DISCONNECTED, **SEE SECTION 11**, FIGURE 11-2, WIRING DIAGRAMS FOR PROPER CONNECTION.
- 7. Insert bolts through the spring shackles and bushings in the leaf spring eyes. Secure bolts with lock nuts. Tighten to 15 ft-lb (20.3 N-m).

- 8. Connect the brake cables.
- 9. Install the shock absorbers. Tighten shock absorber retaining nuts until the rubber bushings expand to the same size as the cup washers.
- 10. Install the rear wheels and finger tighten lug nuts.
- 11. Lift the vehicle and remove the jackstands. Lower vehicle and tighten lug nuts (using a crisscross pattern) to 55 ft-lb (74.6 N-m).
- 12. Test drive the vehicle to check for proper operation.

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Club Car Inc. P.O. Box 204658 Augusta, GA 30917-4658

Club Car



POWERDRIVE SYSTEM 48 ELECTRIC VEHICLES

MANUAL NUMBER 102067505 EDITION CODE 0400E0306C

FOREWORD

The Club Car PowerDrive System 48 electric vehicle is engineered and built to provide the ultimate in performance efficiency. However, timely and appropriate vehicle maintenance and repair is essential for long-term vehicle performance and continued safe and reliable service.

This supplement provides detailed information for the maintenance and repair of PowerDrive System 48 electric vehicles and should be used in conjunction with the appropriate Maintenance and Service Manual. If you do not have the appropriate Maintenance and Service Manual, you may order one from your local Club Car or Carryall representative. Maintenance and Service Manuals available include:

2000 DS Golf Car Maintenance & Service Manual

Publication Part No. 102067501

2000 Turf/Carryall Vehicle Maintenance & Service Manual

Publication Part No. 102067502

2000 Transportation Vehicle Maintenance & Service Manual

Publication Part No. 102067503

This supplement and corresponding Maintenance and Service Manual should be thoroughly reviewed prior to servicing the vehicle. The procedures provided herein must be properly implemented, and the DANGER, WARNING and CAUTION statements must be heeded.

This supplement was written for the vehicle technician who already possesses knowledge and skills in electrical and mechanical repair. If the technician does not have such knowledge and skills, attempted service or repairs to the vehicle may render the vehicle unsafe. For this reason, Club Car advises all repairs and/or service be performed by an authorized Club Car or Carryall distributor/dealer representative or by a Club Car factory trained technician.

This service supplement, along with the appropriate Maintenance and Service Manual, covers all aspects of typical service requirements for the PowerDrive System 48 electric vehicle. If you need additional information, you may write to us at: Club Car, Inc.; P.O. Box 204658; Augusta, GA 30917; Attention: Technical Services, or contact a Club Car technical service representative at (706) 863-3000, extension 3580.

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A WARNING

- READ SECTION 1-SAFETY IN THE APPROPRIATE MAINTENANCE AND SERVICE MANUAL BEFORE ATTEMPTING TO SERVICE THIS VEHICLE.
- BEFORE SERVICING VEHICLE, READ COMPLETE SECTION(S) AND ANY REFERENCED INFORMATION RELEVANT TO SERVICE OR REPAIR TO BE PERFORMED.

NOTE

- THIS SUPPLEMENT REPRESENTS THE MOST CURRENT INFORMATION AT THE TIME OF PUBLICATION. CLUB CAR, INC. IS CONTINUALLY WORKING TO IMPROVE OUR VEHICLES AND OTHER PRODUCTS. THESE IMPROVEMENTS MAY AFFECT SERVICING PROCEDURES. ANY MODIFICATION AND/OR SIGNIFICANT CHANGE IN SPECIFICATIONS OR PROCEDURES WILL BE FORWARDED TO ALL CLUB CAR AND CARRYALL DISTRIBUTORS/DEALERS AND WILL, WHEN APPLICABLE, APPEAR IN FUTURE EDITIONS OF THIS MANUAL.
- DAMAGE TO A VEHICLE OR COMPONENT THEREOF NOT RESULTING FROM A DEFECT OR WHICH OCCURS DUE TO UNREASONABLE OR UNINTENDED USE, OVERLOADING, ABUSE, OR NEGLECT (INCLUDING FAILURE TO PROVIDE REASONABLE OR NECESSARY MAINTENANCE AS INSTRUCTED IN THE VEHICLE OWNER'S MANUAL), ACCIDENT OR ALTERATION, INCLUDING INCREASING VEHICLE SPEED BEYOND FACTORY SPECIFICATIONS OR MODIFICATIONS WHICH AFFECT THE STABILITY OF THE VEHICLE OR THE OPERATION THEREOF, WILL VOID THE WARRANTY.
- CLUB CAR, INC. RESERVES THE RIGHT TO CHANGE SPECIFICATIONS AND DESIGNS AT ANY TIME WITHOUT NOTICE AND WITHOUT INCURRING ANY OBLIGATION OR LIABILITY WHATSOEVER.
- THERE ARE NO WARRANTIES EXPRESSED OR IMPLIED IN THIS MANUAL. SEE THE LIMITED WARRANTY FOUND IN THE VEHICLE OWNER'S MANUAL OR WRITE TO CLUB CAR, INC.

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SECTION 10-PERIODIC MAINTENANCE

A WARNING

- ONLY TRAINED TECHNICIANS SHOULD REPAIR OR SERVICE THIS VEHICLE, ANYONE DOING EVEN SIMPLE REPAIRS OR SERVICE SHOULD HAVE KNOWLEDGE AND EXPERIENCE IN ELECTRICAL AND MECHANICAL REPAIR.
- FOLLOW ALL PROCEDURES EXACTLY AS STATED IN THIS MANUAL. AND HEED ALL DANGER. WARNING AND CAUTION STATEMENTS, AS WELL AS THOSE AFFIXED TO THE VEHICLE.
- CHECK THE VEHICLE OWNER'S MANUAL FOR PROPER LOCATION OF ALL VEHICLE WARNING DECALS AND MAKE SURE THEY ARE IN PLACE AND ARE EASY TO READ.
- IF ANY PROBLEMS ARE FOUND DURING SCHEDULED INSPECTION OR SERVICE, DO NOT OPERATE THE VEHICLE UNTIL REPAIRS ARE MADE. FAILURE TO MAKE NECESSARY REPAIRS COULD RESULT IN FIRE, PROPERTY DAMAGE, SEVERE PERSONAL INJURY, OR DEATH.
- WEAR SAFETY GLASSES OR APPROVED EYE PROTECTION WHILE SERVICING VEHICLE. WEAR A FULL FACE SHIELD WHEN WORKING WITH BATTERIES.
- DO NOT WEAR LOOSE CLOTHING. REMOVE JEWELRY SUCH AS RINGS, WATCHES, CHAINS. ETC. BEFORE SERVICING VEHICLE.
- TURN KEY SWITCH OFF, PLACE FORWARD/REVERSE HANDLE IN THE NEUTRAL POSITION, AND REMOVE KEY PRIOR TO SERVICING.
- MOVING PARTS! DO NOT ATTEMPT TO SERVICE THE VEHICLE WHILE IT IS RUNNING.
- HOT! DO NOT ATTEMPT TO SERVICE HOT MOTOR. FAILURE TO HEED THIS WARNING COULD RESULT IN SEVERE BURNS.
- USE INSULATED TOOLS WHEN WORKING NEAR BATTERIES OR ELECTRICAL CONNECTIONS. USE EXTREME CAUTION TO AVOID SHORTING OF COMPONENTS OR WIRING.
- TO AVOID UNINTENTIONALLY STARTING THE VEHICLE, DISCONNECT BATTERIES AS SHOWN IN FIGURE 10-1, PAGE 10-2, AND THEN DISCHARGE THE CONTROLLER AS FOLLOWS:
 - TURN THE KEY SWITCH TO ON AND PLACE THE FORWARD/REVERSE HANDLE IN THE **REVERSE POSITION.**
 - SLOWLY DEPRESS THE ACCELERATOR PEDAL AND KEEP IT DEPRESSED UNTIL THE REVERSE WARNING BUZZER CAN NO LONGER BE HEARD. WHEN THE BUZZER STOPS SOUNDING, THE CONTROLLER IS DISCHARGED.
- IMPROPER MAINTENANCE OR USE OF THIS VEHICLE COULD RESULT IN DECREASED VEHICLE PERFORMANCE OR SEVERE PERSONAL INJURY.
- ANY MODIFICATION OR CHANGE TO THE VEHICLE WHICH AFFECTS THE STABILITY OR HANDLING OF THE VEHICLE, OR INCREASES MAXIMUM VEHICLE SPEED BEYOND FACTORY SPECIFICATIONS, COULD RESULT IN SEVERE PERSONAL INJURY OR DEATH.
- LIFT ONLY ONE END OF THE VEHICLE AT A TIME. BEFORE LIFTING, UNLOAD CARGO BED. LOCK THE BRAKES AND CHOCK THE WHEELS THAT REMAIN ON THE FLOOR. USE A SUITABLE LIFTING DEVICE (CHAIN HOIST OR HYDRAULIC FLOOR JACK) WITH 1000 LB. (454 KG.) MINIMUM LIFTING CAPACITY. DO NOT USE LIFTING DEVICE TO HOLD VEHICLE IN RAISED POSITION. ALWAYS USE APPROVED JACKSTANDS OF PROPER WEIGHT CAPACITY TO SUPPORT VEHICLE.

PERIODIC MAINTENANCE General Information

GENERAL INFORMATION

To ensure continuing reliable performance of the PowerDrive System 48 vehicle, a Preventive Maintenance program should be established and followed. Preventive Maintenance consists of the regular performance of scheduled vehicle service and maintenance procedures, and is the only way to ensure the vehicle provides the safe, reliable, and economical service it is designed to deliver. The following charts provide recommended service intervals for the lubrication and maintenance of the PowerDrive System 48 vehicle. Note that critical areas such as brake operation, accelerator operation, steering and tires should be inspected daily and maintenance performed as required. Any vehicle that is not functioning properly should be removed from service until it has been repaired.

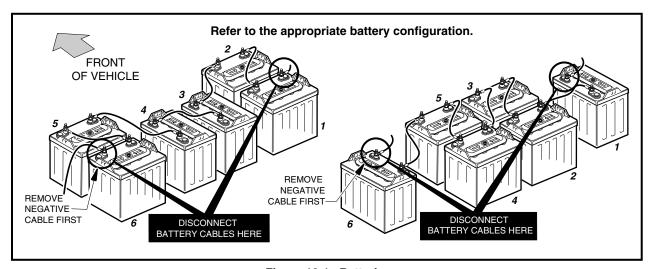


Figure 10-1 Batteries

DAILY PRE-OPERATION SAFETY CHECKLIST

Inspect and drive the vehicle. Use the Pre-Operation Checklist and Performance Inspection in Section 3 of the appropriate Maintenance and Service Manual, as a guide to check the following items.

- · Vehicle warning decals
- Brake system
- · Park brake
- · Reverse warning buzzer
- · Steering and linkages
- · Proper acceleration and maximum speed
- Batteries
- Accelerator Switch

In addition, check the items listed below:

- Tires: Visually inspect for wear, damage and proper inflation.
- Forward/Reverse switch: Check for proper operation. See Controls, Section 3–General Information, in the appropriate Maintenance and Service Manual.
- Charger cord, plug and receptacle. See Charger Receptacle, Section 12–Electrical Components,
 Page 12-13.

PERIODIC SERVICE SCHEDULE

A WARNING

• SERVICE, REPAIRS AND ADJUSTMENTS MUST BE MADE PER INSTRUCTIONS IN THE APPROPRIATE 2000 MAINTENANCE & SERVICE MANUAL AND THIS SUPPLEMENT.

NOTE

- IF THE VEHICLE IS CONSTANTLY SUBJECTED TO HEAVY USE, I.E., HAULING HEAVY LOADS OR PULLING A TRAILER, OR SEVERE OPERATING CONDITIONS, THE PREVENTIVE MAINTENANCE PROCEDURES SHOULD BE PERFORMED MORE OFTEN THAN RECOMMENDED IN THE SERVICE AND LUBRICATION SCHEDULES.
- BOTH THE PERIODIC SERVICE SCHEDULE AND PERIODIC LUBRICATION SCHEDULE MUST BE FOLLOWED TO KEEP VEHICLE IN OPTIMUM OPERATING CONDITION.

PERIODIC SERVICE SCHEDULE			
REGULAR INTERVAL	SERVICE		
Daily Service by Owner	Batteries	Charge batteries (after each use only).	
Weekly Service by Owner	Batteries	Check electrolyte level. Add water as necessary per Section 13–Batteries.	
	Batteries	Wash battery tops and clean terminals with baking soda/water solution. Dispose of waste water properly .	
Monthly Sarvice by Owner	Tires	Check air pressure and adjust as necessary. (See Vehicle Capacities Chart on Page 10-5).	
Monthly Service by Owner or Trained Technician	Multi-step Potentiometer (DS, Turf 1, Carryall 1, and Villager 4 only)	Check for cracks or other damage; make sure switch is securely fastened to frame. Check movable contact for correct operation.	
	General Vehicle	Wash battery compartment and underside of vehicle. Dispose of waste water properly.	
	Brake System	Check brake shoes; replace if necessary. See Section 6 in Maintenance and Service Manual.	
Semiannual Service by		Lubricate brake slides per Lubrication Schedule. See also Section 6 in Maintenance and Service Manual.	
Trained Technician Only		Check brake cables for damage; replace as required.	
(Every 50 hours of operation	Electrical wiring and connections	Check for tightness and damage.	
or 100 rounds of golf).	Forward and Reverse Switch	Check condition of contacts and wire connections; make sure connections are tight.	
	Front Wheel Alignment and Camber	Check and adjust as required. See Section 7 in Maintenance and Service Manual.	
,			
Annual Service by Trained Technician Only (Every 100 hours of opera- tion or 200 rounds of golf).	Batteries	If batteries are not performing as expected, refer to Section 13–Batteries.	

A WARNING

• IF ANY PROBLEMS ARE FOUND, DO NOT OPERATE THE VEHICLE UNTIL REPAIRS ARE MADE. FAILURE TO MAKE NECESSARY REPAIRS COULD RESULT IN FIRE, PROPERTY DAMAGE, SEVERE PERSONAL INJURY OR DEATH.

U PERIODIC MAINTENANCE Lubrication

LUBRICATION

PERIODIC LUBRICATION SCHEDULE			
REGULAR INTERVAL	SERVICE	PLACE*	RECOMMENDED LUBRICANT
Semi-Annually by Owner or Trained Technician (Every 50 hours of operation or every 100 rounds of golf)	Brake pedal shaft bearings	1.	Dry Moly Lube - Club Car Part No. 1012151
	Brake Linkage and Pivots	2.	Dry Moly Lube - Club Car Part No. 1012151
	Accelerator push rod pivots and mounts	3.	Dry Moly Lube - Club Car Part No. 1012151
	Forward/Reverse Switch Contacts and charger receptacle	4.	WD 40
	Brake Slides	5.	Dry Moly Lube - Club Car Part No. 1012151
	Front Suspension (5 fittings)	6.	Chassis Lube - EP NLGI Grade 2
Annually by Trained Technician Only (Every 100 hours of operation or 200 rounds of golf)	Check/fill transaxle to plug level	7.	22 oz. (.67 liter) SAE 30 WT.
	Inspect front wheel bearings (Repack as necessary)	8.	Chassis Lube - EP NLGI Grade 2

^{*}See following Figures 10-2 and 10-3.

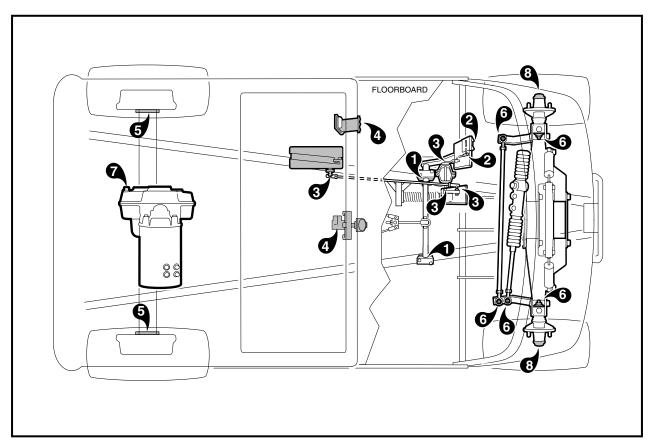


Figure 10-2 Vehicle Lubrication Points-DS, Turf 1, Carryall 1 and Villager 4

Lubrication, Continued:

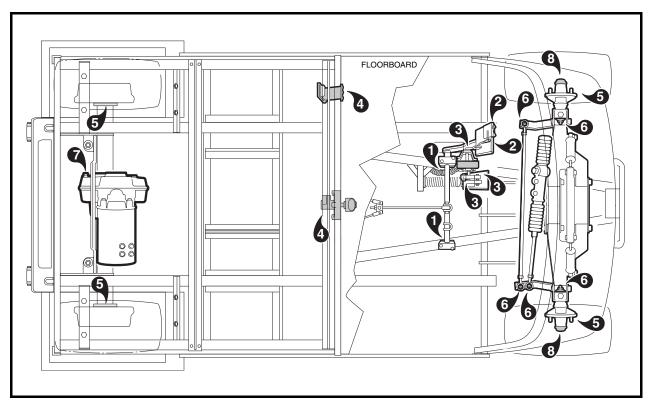


Figure 10-3 Vehicle Lubrication Points-Turf 2, Carryall 2, Villager 6 and 8 and TransPorter

VEHICLE CAPACITIES

CAPACITIES			
Transaxle	22 oz. (.67 liters)		
Tire Pressure	18-20 psi (124-138 kPa) (4-ply tires)		
Tire Pressure	30-34 psi (207-234 kPa) (6-ply tires)		

SECTION 11-ELECTRICAL SYSTEM AND TESTING

A DANGER

- BATTERY EXPLOSIVE GASES! DO NOT SMOKE, KEEP SPARKS AND FLAMES AWAY. VENTILATE WHEN CHARGING OR USING IN AN ENCLOSED SPACE. ALWAYS WEAR FULL FACE SHIELD AND RUBBER GLOVES WHEN WORKING ON OR NEAR BATTERIES.
- USE EXTREME CAUTION WHEN USING TOOLS, WIRES, OR METAL OBJECTS NEAR BATTERIES! A SHORT CIRCUIT AND (OR) SPARK COULD CAUSE AN EXPLOSION.
- BATTERY POISON! CONTAINS ACID! CAUSES SEVERE BURNS. AVOID CONTACT WITH SKIN, EYES, OR CLOTHING. ANTIDOTES:
 - EXTERNAL: FLUSH WITH WATER. CALL A PHYSICIAN IMMEDIATELY.
 - INTERNAL: DRINK LARGE QUANTITIES OF MILK OR WATER. FOLLOW WITH MILK OF MAGNESIA OR VEGETABLE OIL. CALL A PHYSICIAN IMMEDIATELY.
 - EYES: FLUSH WITH WATER FOR FIFTEEN MINUTES. CALL PHYSICIAN IMMEDIATELY.

WARNING

- ONLY TRAINED TECHNICIANS SHOULD REPAIR OR SERVICE THIS VEHICLE. ANYONE DOING EVEN SIMPLE REPAIRS OR SERVICE SHOULD HAVE KNOWLEDGE AND EXPERIENCE IN ELECTRICAL AND MECHANICAL REPAIR.
- FOLLOW ALL PROCEDURES EXACTLY AS STATED IN THIS MANUAL, AND HEED ALL DANGER, WARNING AND CAUTION STATEMENTS, AS WELL AS THOSE AFFIXED TO THE VEHICLE.
- WEAR SAFETY GLASSES OR APPROVED EYE PROTECTION WHILE SERVICING VEHICLE.
- TURN KEY SWITCH OFF, PLACE FORWARD/REVERSE HANDLE IN THE NEUTRAL POSITION, AND REMOVE KEY PRIOR TO SERVICING.
- DO NOT WEAR LOOSE CLOTHING. REMOVE JEWELRY SUCH AS RINGS, WATCHES, CHAINS, ETC. BEFORE SERVICING VEHICLE.
- USE INSULATED TOOLS WHEN WORKING NEAR BATTERIES OR ELECTRICAL CONNECTIONS. USE EXTREME CAUTION TO AVOID SHORTING OF COMPONENTS OR
- TO AVOID UNINTENTIONALLY STARTING THE VEHICLE, DISCONNECT BATTERIES, NEGATIVE CABLE FIRST, AS SHOWN IN FIGURE 11-1, PAGE 11-2, AND THEN DISCHARGE THE **CONTROLLER AS FOLLOWS:**
 - TURN THE KEY SWITCH TO ON AND PLACE THE FORWARD/REVERSE HANDLE IN THE **REVERSE** POSITION.
 - SLOWLY DEPRESS THE ACCELERATOR PEDAL AND KEEP IT DEPRESSED UNTIL THE REVERSE WARNING BUZZER CAN NO LONGER BE HEARD. WHEN THE BUZZER STOPS SOUNDING, THE CONTROLLER IS DISCHARGED.

GENERAL INFORMATION

The PowerDrive System 48 vehicle uses a 48-volt electrical system that is powered by six 8-volt lead-acid batteries and includes an onboard computer. The PowerDrive System 48 vehicle uses a series wound motor which increases or decreases the current flow (amperage) through the armature and field coils at the same rate.

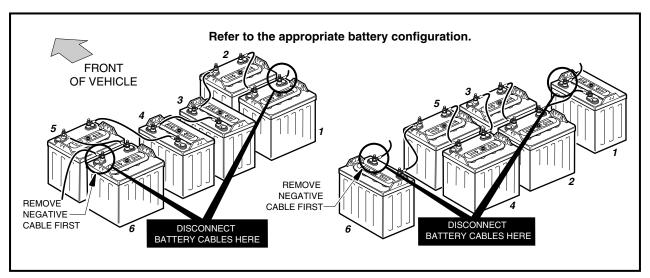


Figure 11-1 Battery Configuration

ELECTRICAL CIRCUITS

There are four separate circuits which make up the electrical system of the PowerDrive System 48 vehicle: 1) the control circuit, 2) the power circuit, 3) the speed control circuit, and 4) the charge circuit. A reverse buzzer is also included on every vehicle.

CONTROL CIRCUIT

The control circuit consists of:

- 1. Key switch
- 2. Forward/Reverse (F&R) anti-arcing limit switch
- 3. Accelerator limit switch
- 4. Solenoid Activating Coil

POWER CIRCUIT

The power circuit consists of:

- 1. Solid state speed controller
- 2. Solenoid contacts
- 3. F&R switch
- 4. Motor
- 5. Batteries

SPEED CONTROL CIRCUIT

For models with a multi-step potentiometer, the speed control circuit consists of the multi-step potentiometer with discrete resistors. For models equipped with a continuously variable potentiometer, the speed control circuit includes a solid state potentiometer.

CHARGE CIRCUIT

The charge circuit includes the onboard computer, battery charger, DC charger plug, charger receptacle, receptacle fuse link (TransPorter vehicles and Carryall 6 vehicles with onboard chargers will not have a charger receptacle or receptacle fuse link), and the 8-volt batteries. The onboard fuse link provides additional protection to the vehicle charging circuit. The fuse is rated for use with the Club Car PowerDrive charger only.

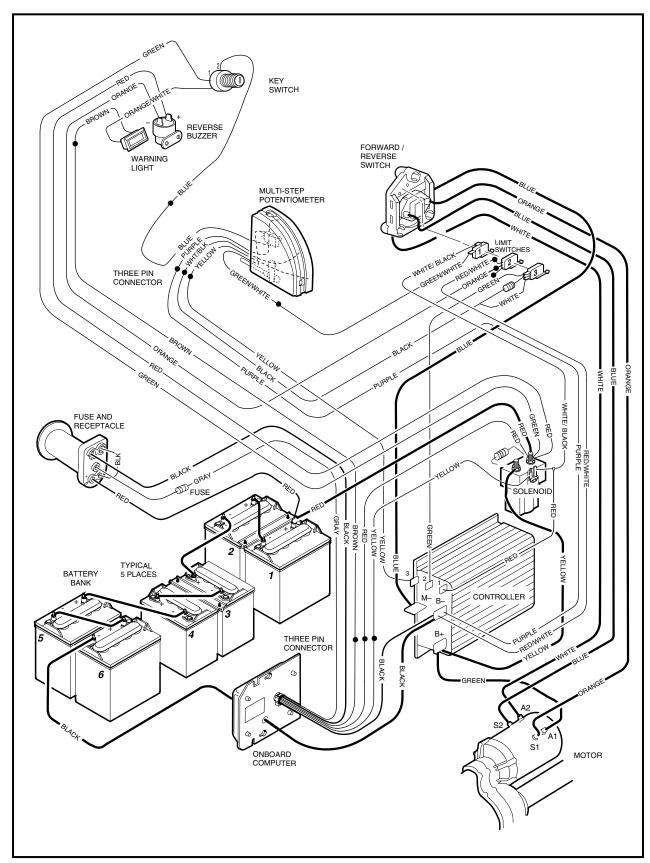


Figure 11-2 Wiring Diagram – DS and Villager 4 Electric Vehicles

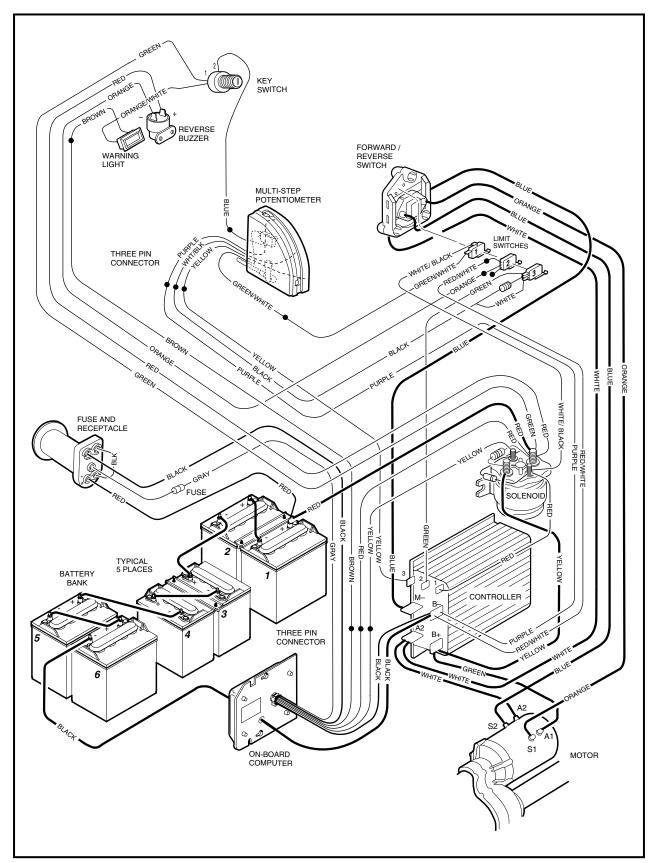


Figure 11-3 Wiring Diagram – Turf 1 and Carryall 1

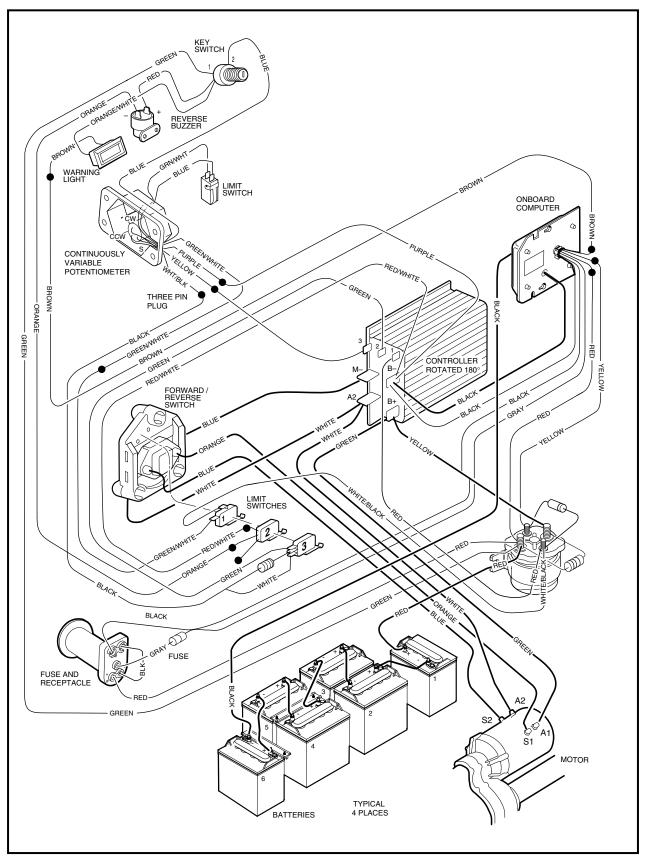


Figure 11-4 Wiring Diagram – Turf 2 and Carryall 2

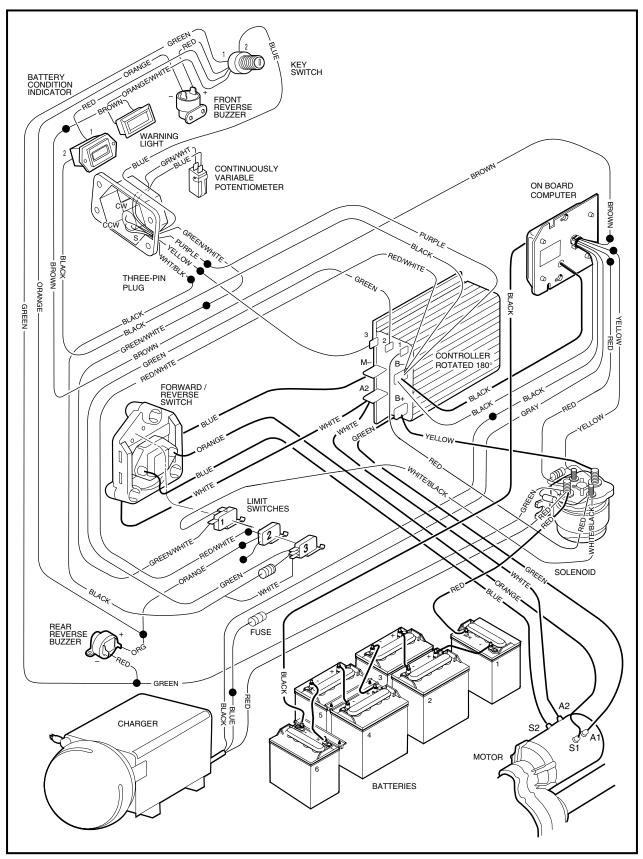


Figure 11-5 Wiring Diagram – Carryall 6 and TransPorter Vehicles

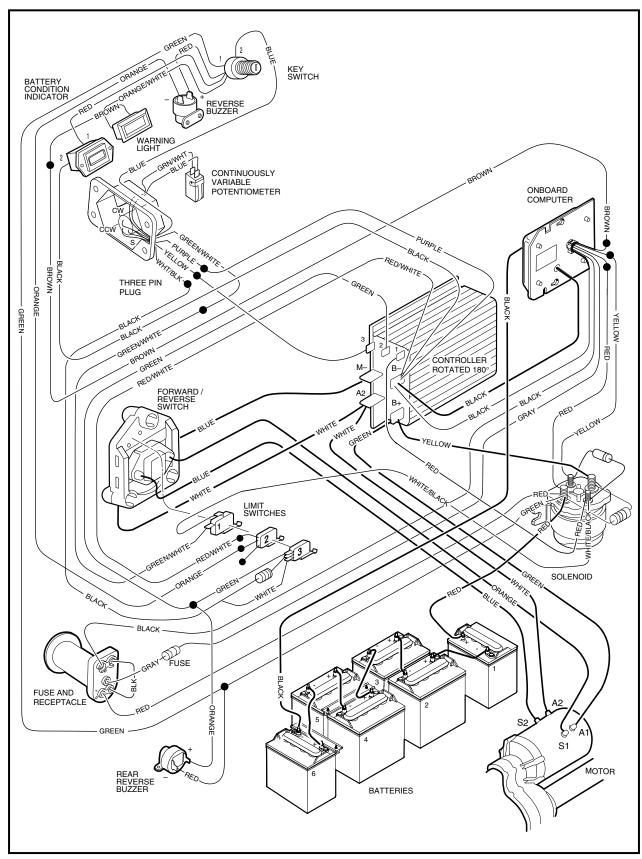


Figure 11-6 Wiring Diagram – Villager 6 and 8 Vehicles

DIAGNOSTIC FLOW CHART

BATTERY WARNING LIGHT

Use this chart as a starting point for troubleshooting when the battery warning light is illuminated. More detailed system testing instructions follow.

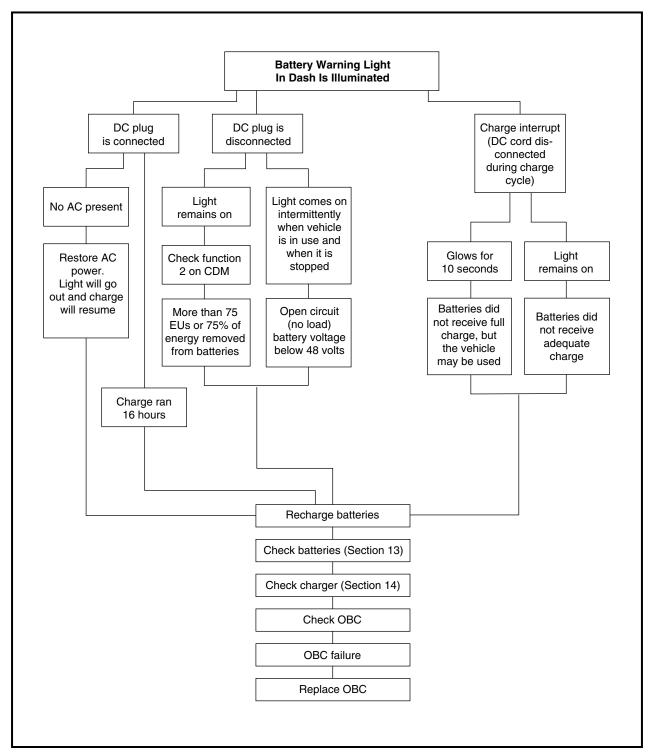


Figure 11-7 Battery Warning Light Diagnostic Chart

TROUBLESHOOTING GUIDE

	SYMPTOM	PROBLEM		POSSIBLE CAUSES	REFER TO
1.	•	Batteries	1)	Battery connections.	Test Procedure 1, Page 11-12
	no solenoid click.		2)	Batteries discharged.	Test Procedure 1, Page 11-12
		Key Switch	1)	Loose wires.	Test Procedure 2, Page 11-13
			2)	Failed switch.	Test Procedure 2, Page 11-13
		F&R Anti-arcing Limit Switch	1)	Loose wires.	Test Procedure 3, Page 11-14
			2)	Failed switch.	Test Procedure 3, Page 11-14
			3)	Cam is not activating switch.	Section 12–Electrical Components, F&R Anti-arcing Limit Switch
		Accelerator	1)	Accelerator rod disconnected. (Multi-step Pot. vehicles only)	Section 5–Accelerator and Brake Pedal
		Accelerator Pedal Limit	1)	Loose wire.	Test Procedure 4, Page 11-14
		Switch	2)	Disconnected or improperly connected wires.	Figures 11-2 through 11-6, Pages 11-3 through 11-7
			3)	Failed switch.	Test Procedure 4, Page 11-14
		Solenoid	1)	Loose wires.	Test Procedure 5, Page 11-15
			2)	Failed coil.	Test Procedure 5, Page 11-15
			3)	Failed solenoid diode.	Test Procedure 5, Page 11-15
		Controller Electrical Leakage	1)	Dirt or acid residue on the controller.	Test Procedure 10, Page 11-20
		Onboard Computer	1)	Battery connections.	Figure 11-1, Page 11-2
			2)	Onboard computer solenoid lockout failure.	Test Procedure 11, Page 11-22
2.	Vehicle will not operate – solenoid clicks.	Batteries	1)	Battery connections.	Test Procedure 1, Page 11-12
			2)	Batteries discharged.	Test Procedure 1, Page 11-12
		Solenoid	1)	Loose wires.	Figures 11-2 through 11-6, Pages 11-3 through 11-7
			2)	Failed contacts.	Test Procedure 7, Page 11-18
		Forward and Reverse Switch	1)	Loose wires.	Test Procedure 6, Page 11-17
			2)	Failed contacts.	Test Procedure 6, Page 11-17
		Potentiometer	1)	Loose wires.	Figures 11-2 through 11-6, Pages 11-3 through 11-7
			2)	Improperly wired.	Figures 11-2 through 11-6, Pages 11-3 through 11-7
			3)	Short or open circuit.	Test Procedures 8 or 9, pages 11-18 and 11-19
			4)	Improperly adjusted.	Section 5–Accelerator & Brake Pedal
		Controller	1)	Loose wires.	Test Procedure 10, Page 11-20
			2)	Failed Speed Controller.	Test Procedure 10, Page 11-20
		Motor	1)	Loose wires.	Section 15–Motor
			2)	Open/shorted windings.	Section 15–Motor

	SYMPTOM	PROBLEM		POSSIBLE CAUSES	REFER TO
3.	Vehicle runs slowly.	Wiring	1)	Improperly wired.	Figures 11-2 through 11-6, Pages 11-3 through 11-7
		Batteries	1)	Loose terminals or corrosion.	Test Procedure 1, and Section 13–Batteries
			2)	Improperly wired.	Test Procedure 1 and Section 13–Batteries
			3)	Batteries failed.	Test Procedure 1 and Section 13–Batteries
			4)	Batteries not fully charged.	Test Procedure 1 and Batteries, Section–13
		Motor	1)	Loose wires.	Section 15–Motor
			2)	Failed motor.	Section 15–Motor
		Potentiometer	1)	Improperly adjusted.	Test Procedures 8 and 9, page 11-18 and 11-19
			2)	Failed potentiometer.	Test Procedures 8 and 9, page 11-18 and 11-19
		Half-speed Reverse Limit	1)	Failed in the closed position.	Test Procedure 12, Page 11-23
		Switch	2)	Improperly wired.	Figures 11-2 through 11-6, Pages 11-3 through 11-7
		Controller	1)	Vehicle overload.	Let controller cool, remove part of load.
			2)	Failed Speed Controller.	Test Procedure 10, Page 11-20
		Brakes	1)	Dragging brakes.	Section 6-Brakes
		Tires	1)	Under-inflated or flat tires.	Section 8–Wheels and Tires
4.	Vehicle runs full speed in reverse.	Forward/Reverse Half-speed Reverse Limit Switch	1)	Loose or disconnected wires.	Section 12– Electrical Components
			2)	Failed switch.	Section 12– Electrical Components
		Half speed (5100 Ω ohm) Resistor	1)	Resistor is disconnected or has failed.	Test Procedure 13, Page 11-24
5.	Vehicle will run in forward but not in reverse, or will run in reverse but not forward.	Forward/Reverse Anti-arcing Limit Switch	1)	Loose or broken wires.	Test Procedure 3 and Section 12–Electrical Compo- nents
			2)	Improper actuation of switch.	Test Procedure 3 and Section 12– Electrical Components
			3)	Improperly wired.	Test Procedure 3 and Section 12– Electrical Components
		Forward/Reverse Switch	1)	Poor continuity of switch contacts.	Test Procedure 6, Page 11-17
6.	Vehicle not being fully charged.	Charger Connections	1)	Loose wires at receptacle or batteries.	Section 14–PowerDrive Charger
		Charger	1)	Incorrect incoming AC voltage.	Section 14–PowerDrive Charger
			2)	Charger output is low.	Section 14–PowerDrive Charger
			3)	Charger cord and plugs.	Section 14–PowerDrive Charger

	SYMPTOM	PROBLEM		POSSIBLE CAUSES	REFER TO
6.	Vehicle not being fully charged (continued).	Charger, Continued:	4)	Charger relay.	Section 14–PowerDrive Charger
			5)	Charger fuse is blown.	Section 14–PowerDrive Charger
		Charger/Onboard Computer	1)	Improper charging.	Section 14–PowerDrive Charger
7.	Vehicle runs without pressing the accelerator when the key is on and the Forward/ Reverse Switch is in forward or reverse.	Accelerator	1)	Improper pedal adjustment.	Section 5–Accelerator and Brake Pedal Group
8.	Solenoid clicks when the key is turned on.	Accelerator Limit Switch	1)	Failed switch.	Test Procedure 4, Page 11-14
			2)	Improper pedal adjustment.	Section 5–Accelerator and Brake Pedal Group

TEST PROCEDURES

Using the following procedures, the entire PowerDrive electrical system can be tested without major disassembly of the vehicle.

A CAUTION

IF WIRES ARE REMOVED OR REPLACED MAKE SURE WIRING AND/OR WIRING HARNESS IS
PROPERLY ROUTED AND SECURED TO VEHICLE FRAME. FAILURE TO PROPERLY ROUTE
AND SECURE WIRING COULD RESULT IN VEHICLE MALFUNCTION, PROPERTY DAMAGE OR
PERSONAL INJURY.

INDEX OF TEST PROCEDURES

- 1. Batteries / Voltage Check
- 2. Key Switch
- 3. Forward/Reverse Anti-Arcing Limit Switch
- 4. Accelerator Pedal Limit Switch
- 5. Solenoid Activating Coil and Diode
- 6. Forward/Reverse (F&R) Switch
- 7. Solenoid Contacts (Power Off) and Resistor
- 8. Multi-Step Potentiometer
- 9. Continuously Variable Potentiometer
- Solid State Speed Controller
- 11. Onboard Computer Lockout Circuit
- 12. Half-Speed Reverse Limit Switch (F&R Limit Switch No. 3)
- 13. Half-Speed Reverse Resistor
- 14. Reverse Buzzer Limit Switch
- 15. Reverse Buzzer
- 16. Wire Continuity
- 17. Battery Warning Light
- 18. Voltage at Charger Receptacle Red Wire Socket

Test Procedure 1-Batteries / Voltage Check Read DANGER and WARNING on page 11-1.

1. With batteries connected and using a multimeter set to 200 volts DC, place red (+) probe on the positive post of battery No. 1 and the black (–) probe on the negative post of battery No. 6. The multimeter should indicate at least 48 volts with the batteries fully charged. If not, check for loose battery connections or a battery installed in reverse polarity. Refer to **Section 13–Batteries**, for further details on battery testing (**Figure 11-8**, **Page 11-12**).

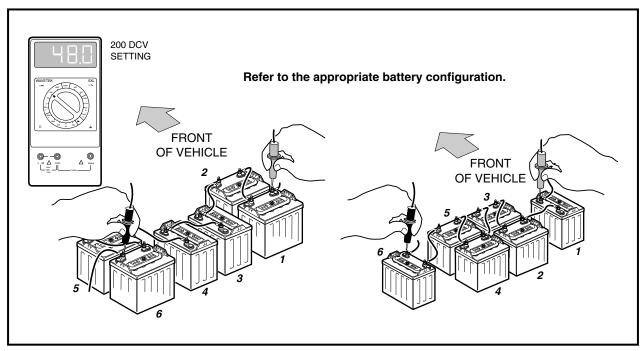


Figure 11-8 Battery Test

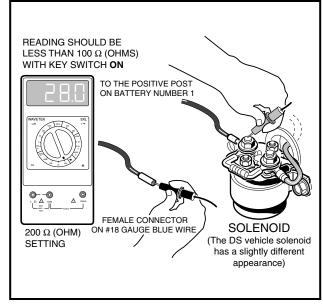


Figure 11-9 Key Switch Test (Multi-step Potentiometer Vehicles)

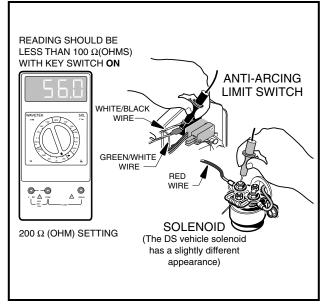


Figure 11-10 Key Switch Test (All Electric Vehicles)

Test Procedure 2–Key Switch

Read DANGER and WARNING on page 11-1.

Vehicles with Multi-step (Wiper Switch) Potentiometer:

- 1. With batteries disconnected, place red (+) probe of multimeter set to 200 Ω (ohms) on large terminal of solenoid (with red wire attached) (Figure 11-9, Page 11-12).
- 2. Disconnect the blue wire from the multi-step potentiometer and place the black (–) probe on the terminal of the blue wire (wire harness side) (Figure 11-9, Page 11-12).
- 3. With the key switch OFF, the reading should be no continuity. If continuity is shown, check the key switch, wires and terminals, and then replace parts as required.
- 4. Insert the key and turn the switch ON. The reading should be continuity (less than 100 Ω ohms).
- 5. If the reading is incorrect, check the key switch, wires and terminals, and then replace parts as required.
- 6. Reconnect the blue wire to the wire harness.
- 7. Place red (+) probe of multimeter on large terminal of solenoid (with red wire attached) and place black (–) probe at green/white wire from the Forward/Reverse limit switch No. 1 (Figure 11-10, Page 11-12).
- 8. Depress and hold the accelerator pedal to activate the accelerator pedal limit switch.
- 9. With the key switch OFF the reading should be no continuity.
- 10. Insert key and turn switch ON while continuing to depress accelerator pedal. Reading should be continuity (less than 100 Ω ohms).
- 11. If reading is incorrect, check accelerator limit switch, wires and terminals, and replace parts as required.

Vehicles with Continuously Variable Potentiometer:

- 1. Place red (+) probe of multimeter on large terminal of solenoid (with red wire attached) and place black (–) probe at green/white wire from the Forward/Reverse limit switch No. 1 (Figure 11-10, Page 11-12).
- 2. Depress and hold the accelerator pedal to activate the accelerator pedal limit switch.
- 3. With the key switch OFF the reading should be no continuity (less than 100 Ω ohms).
- 4. Insert key and turn switch ON while continuing to depress accelerator pedal. Reading should be continuity.
- 5. If the reading is incorrect, check the key switch, accelerator limit switch, wires and terminals, and replace parts as required.

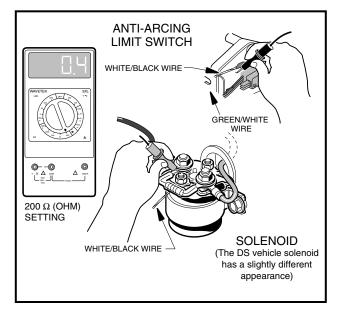
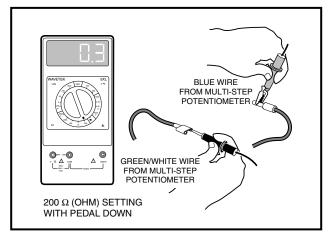


Figure 11-11 F&R Anti-Arcing Limit Switch Test

Test Procedure 3–Forward/Reverse Anti-Arcing Limit Switch Read DANGER and WARNING on page 11-1.

NOTE

- THERE ARE THREE LIMIT SWITCHES ON THE FORWARD/REVERSE SWITCH. THE FORWARD/ REVERSE ANTI-ARCING LIMIT SWITCH IS THE ONE CLOSEST TO THE VEHICLE BODY.
- 1. With batteries disconnected, place the red (+) probe of the multimeter (set for 200 Ω ohms) on the small activating coil post of the solenoid that has the red wire connected. Place the black (–) probe on the No. 1 anti-arcing limit switch at the normally open (NO) terminal (Figure 11-11, Page 11-13).
- Reading should show continuity when Forward/Reverse handle is placed in either FORWARD or REVERSE and no continuity when in NEUTRAL and when in FORWARD or REVERSE (until the rotor contacts are in contact with contact bars). If not, check wires and terminals. If readings are still incorrect, replace switch.



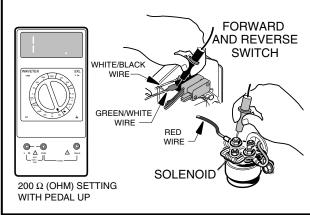


Figure 11-12 Limit Switch Test (Multi-step)

Figure 11-13 Limit Switch Test (Cont. Variable)

Test Procedure 4–Accelerator Pedal Limit Switch Read DANGER and WARNING on page 11-1.

Vehicles with Multi-step (Wiper Switch) Potentiometer:

- 1. Disconnect batteries. Disconnect the blue and the green/white wires from the multi-step potentiometer.
- 2. Place the black (–) probe of multimeter, set for 200 Ω (ohms), on the green/white wire terminal (wiper switch side) and the red (+) probe on the blue wire bullet terminal (wiper switch side) (Figure 11-12, Page 11-14).
- 3. With the accelerator pedal fully up (not depressed), the reading should be no continuity.
- 4. With the key switch OFF, depress the accelerator pedal. The reading should be continuity.
- If readings for steps 2 and 3 are not correct, check wire connection at the normally closed (NC) and common (COM) terminals of accelerator pedal limit switch (located inside wiper switch). Check accelerator pedal adjustment. See Section 5–Accelerator and Brake Pedal.
- If wires are connected correctly and accelerator pedal is properly adjusted, but readings are still not correct, replace limit switch. See Accelerator Pedal Limit Switch, Section 12-Electrical Components, Page 12-7.

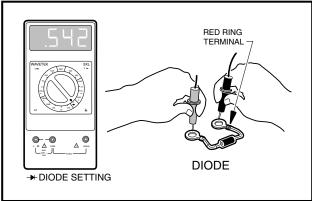
Vehicles with Continuously Variable Potentiometer:

- 1. With batteries disconnected, controller discharged and the key switch in the ON position, connect the red lead of a multimeter (set for 200 Ω ohms) to the large post of the solenoid (with 6 gauge red wire attached) and connect the black lead of the multimeter to the green/white wire from limit switch No. 1 on the Forward/Reverse switch (Figure 11-13, Page 11-14).
 - 1.1. With the accelerator pedal fully upright (not depressed), the reading should be no continuity.
 - 1.2. With the accelerator pedal depressed, the reading should be continuity.
- If these readings are not obtained, check to be sure that the wires are connected properly to the normally open (NO) and common (COM) terminals of the accelerator pedal limit switch located on the continuously variable potentiometer. Check accelerator and brake pedal adjustment. See Section 5
 Accelerator and Brake Pedal.
- 3. If wires are connected correctly and accelerator pedal is properly adjusted, but readings are incorrect, replace accelerator pedal limit switch.

Test Procedure 5-Solenoid Activating Coil and Diode Read DANGER and WARNING on page 11-1.

All Vehicles Except the DS Electric:

- 1. With batteries disconnected, remove the diode terminal end from the small post on the solenoid (with 18 gauge yellow wire attached).
- 2. Make sure that the diode direction is correct (Figures 11-2 through 11-6, Pages 11-3 through 11-7). The red terminal end of the diode attaches to the small post of the solenoid (with 18 gauge red wire and 18 gauge white/black striped wire attached).
- 3. Using a multimeter set for diode, check for continuity between both diode terminals. Reverse the tester leads and again check for continuity. A diode is designed to conduct current in one direction only. If a diode shows continuity in both directions or does not show continuity in either direction, replace the diode assembly (Figure 11-14, Page 11-15).
- 4. With diode assembly and yellow wire removed from the small activating coil post of the solenoid, place red (+) probe of the multimeter on the post. Place the black (–) probe on the other small activating coil post on the solenoid. A reading of 190 to 250 Ω (ohms) should be obtained. If not, replace the solenoid. If the ohm reading is correct, reconnect the diode assembly and yellow wire (Figure 11-15, Page 11-15).



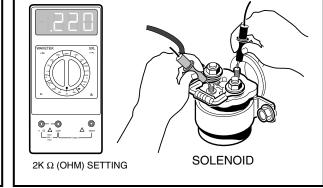


Figure 11-14 Diode Test

Figure 11-15 Activating Coil Test

DS Electric Vehicles Only:

- 1. With batteries disconnected, remove the two small wire terminals from the solenoid.
- The diode must be checked and found to be functioning correctly **before** the activating coil resistance can be accurately measured. The diode can **only** be tested using a continuity test light (Club Car Part No. 1011273).

Test Procedure 5, Continued:

- 2.1. Place the probe end of the tester on the small terminal of the solenoid marked positive (+) and clip the wire on the other small activating coil terminal of the solenoid (Figure 11-16, Page 11-16). The tester should illuminate, indicating continuity.
- 2.1. Reverse the positions of the probe and clip (Figure 11-17, Page 11-16). The tester should **not** illuminate. If any other reading is obtained, the diode must be replaced. If the diode is functioning correctly, proceed to step 4.
- 3. To remove the diode (12), carefully clip the two leads where they attach to the solenoid terminals (Figure 11-17, Page 11-16). See following NOTE.

NOTE

- THE DIODE MUST BE FUNCTIONING CORRECTLY BEFORE CHECKING THE RESISTANCE OF THE ACTIVATING COIL. IN THE CASE OF A FAILED DIODE, THE DIODE MUST BE REMOVED BEFORE THE COIL RESISTANCE CAN BE CHECKED.
- 4. Place red (+) probe of the multimeter on the positive (+) solenoid terminal. Place the black (–) probe on the other small solenoid terminal. A reading of 180 to 190 Ω (ohms) should be obtained. If not, replace the solenoid (Figure 11-18, Page 11-16).
- If a failed diode was removed, replace the diode by installing a new diode assembly (Club Car part No. 1014948), making sure that the red ring terminal of the replacement diode is connected to the positive (+) solenoid terminal.

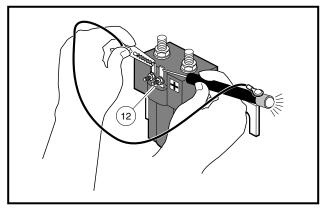


Figure 11-16 Diode Test (DS Vehicle Only)
Probe Position One

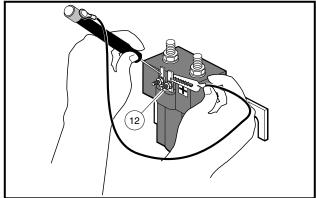


Figure 11-17 Diode Test (DS Vehicle Only)
Probe Position Two

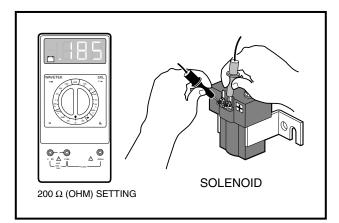


Figure 11-18 Activating Coil Test (DS Vehicle Only)

Test Procedure 6–Forward/Reverse (F&R) Switch Read DANGER and WARNING on page 11-1.

- Disconnect batteries and use a multimeter (set to 200 Ω) to test the F&R switch in both directions. With Forward/ Reverse handle in FORWARD, place red (+) probe of multimeter on M– terminal of speed controller and place black (–) probe on S1 motor terminal. Meter should indicate continuity (Figure 11-19, Page 11-17).
- 2. With Forward/Reverse handle in FORWARD, place red (+) probe on A2 motor terminal, and place the black (–) probe on the S2 motor terminal. Meter should indicate continuity (Figure 11-20, Page 11-17).
- 3. With Forward/Reverse handle in REVERSE, place red (+) probe on speed controller M– terminal and place black (–) probe on S2 motor terminal. Meter should indicate continuity (Figure 11-21, Page 11-17).
- 4. With Forward/Reverse handle in REVERSE, place red (+) probe on the A2 motor terminal and the black (-) probe on the S1 motor terminal. Meter should indicate continuity. If continuity cannot be obtained, and all wires and connections are correct, replace F&R switch (Figure 11-22, Page 11-17).

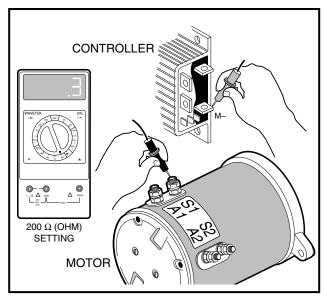


Figure 11-19 F&R Test (Forward Position)

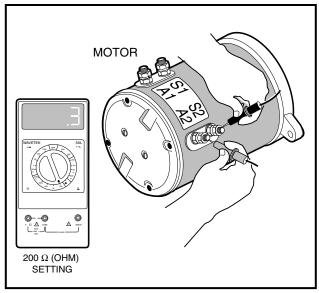


Figure 11-20 F&R Continuity Test (Forward Position)

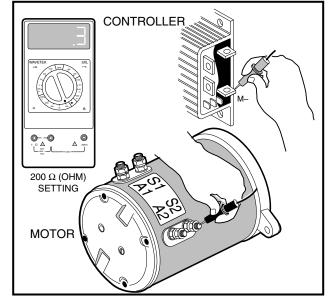


Figure 11-21 F&R Test (Reverse Position)

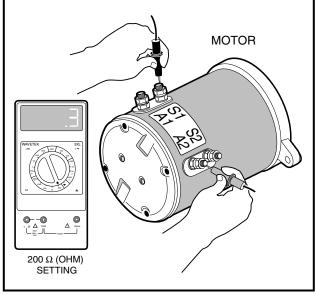
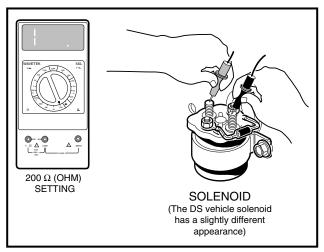


Figure 11-22 F&R Continuity Test (Reverse Position)

Test Procedure 7–Solenoid Contacts (Power Off) and Resistor Read DANGER and WARNING on page 11-1.

- With batteries disconnected and the speed controller discharged, remove all wires from the large posts
 of the solenoid. Remove resistor assembly. Place the red (+) probe of the multimeter on one of the
 large posts of the solenoid and the black (-) probe of the meter on the other large post on the solenoid.
 Multimeter should indicate no continuity. If multimeter indicates continuity, replace solenoid (Figure 1123, Page 11-18).
- 2. Using a multimeter set to $2k \Omega$ (ohms), check for resistance between both resistor terminals. If reading is not approximately 250 Ω (ohms), replace the resistor (Figure 11-24, Page 11-18).



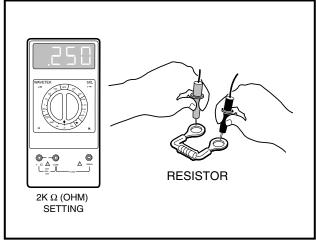


Figure 11-23 Solenoid Contact Test

Figure 11-24 Resistor Test

Test Procedure 8–Multi-Step Potentiometer Read DANGER and WARNING on page 11-1.

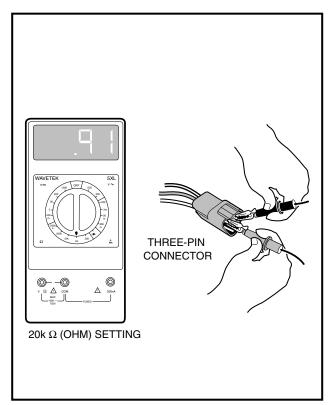
- 1. Disconnect the battery cables (negative cable first) and then disconnect the three-pin connector at multi-step potentiometer. Remove switch cover by pressing down on the locking tabs.
- 2. With multimeter set for 20k Ω (ohms), connect black (–) lead of multimeter to purple wire terminal end (located in three-pin connector on potentiometer). Connect red (+) probe to yellow wire terminal end (Figure 11-25, Page 11-19).
- 3. With the accelerator pedal fully up (not depressed), the reading should be approximately 0 Ω (ohms).
- 4. Measure resistance while depressing the accelerator pedal. The measured resistance should increase incrementally in six steps:

1st Step: 910 Ω (ohms) (approx.) 2nd Step: 1660 Ω (ohms) (approx.) 3rd Step: 2570 Ω (ohms) (approx.) 4th Step: 3570 Ω (ohms) (approx.) 5th Step: 4570 Ω (ohms) (approx.) 6th Step: 5570 Ω (ohms) (approx.)

NOTE

• IF AN INCREASE IN RESISTANCE FROM 0 TO (APPROXIMATELY) 5000 Ω (OHMS) IS OBTAINED WHEN THE ACCELERATOR PEDAL IS DEPRESSED WITHOUT EXCEEDING (APPROXIMATELY) 7000 Ω (OHMS), THEN THE SPEED SWITCH RESISTOR ASSEMBLY IS IN GOOD CONDITION.

- 5. If the resistance steps were not correct and the accelerator pedal is properly adjusted, then replace the failed resistor(s). See Section 12–Electrical Components.
- 6. Replace wiper switch cover and reconnect three-pin connector assembly.



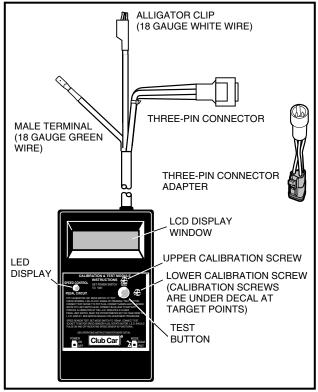


Figure 11-25 Multi-step Potentiometer Test

Figure 11-26 Calibration Test Module

Test Procedure 9–Continuously Variable Potentiometer Read DANGER and WARNING on page 11-1.

- Disconnect the battery cables (negative cable first) and then disconnect the three-pin connector from the main wire harness. The connector emerges from under the front body floorboard (Figure 11-27, Page 11-19). Turn key switch ON and place Forward/Reverse handle in NEUTRAL.
- 2. Connect Calibration Test Module (CTM) (Club Car Part number 101887101) to the three-pin connector using plug adapter (Club Car Part Number 101984501) (Figure 11-26, Page 11-19).

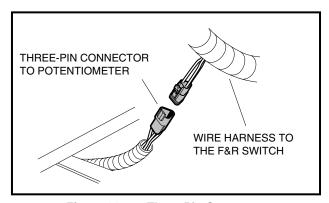


Figure 11-27 Three-Pin Connector

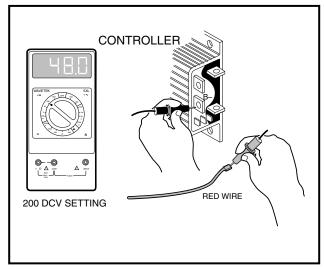
Test Procedure 9, Continued:

- 3. Turn CTM ON. Set mode switch to POT. With accelerator pedal fully upright (not depressed), reading should be approximately 3.62 volts.
- 4. Press accelerator pedal to the floor. Voltage reading should be 0 volts. If readings are not correct, see Potentiometer Adjustment Procedure in Section 5–Accelerator and Brake Pedal, in the appropriate Maintenance and Service Base Manual.

Test Procedure 10–Solid State Speed Controller Read DANGER and WARNING on page 11-1.

A DANGER

• TURN KEY TO OFF, PLACE FORWARD/REVERSE HANDLE IN NEUTRAL AND DISCONNECT BATTERY CABLES AS SHOWN IN FIGURE 11-1, PAGE 11-2. FAILURE TO DO SO MAY CAUSE THE VEHICLE TO RUN OVER YOU, RESULTING IN SEVERE INJURY OR DEATH.



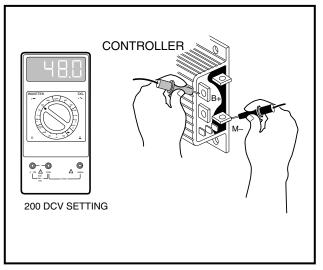


Figure 11-28 Input Voltage Test

Figure 11-29 Output Voltage Test

- 1. Because the solid state speed controller is a sealed solid state unit, it requires almost no maintenance. It is recommended, however, the following two operations be done occasionally.
 - 1.1. Make sure electrical connections to controller are tight. When checking controller bus bar connections for tightness, be sure to use double-wrench technique to avoid stressing bus bars and cracking seals.
 - 1.2. Remove any corrosion or accumulation of dirt, acid, fertilizer etc., from the terminal area. It is especially important that the controller terminal face be free of dirt and debris to help prevent electrical leakage that could cause faulty operation.
- 2. Check for solenoid input.

NOTE

• BEFORE ATTEMPTING THE FOLLOWING TESTS, THE REAR OF THE VEHICLE MUST BE RAISED AND SECURED ON JACKSTANDS WITH THE DRIVE WHEELS OFF THE GROUND.

A WARNING

- LIFT ONLY ONE END OF THE VEHICLE AT A TIME. BEFORE LIFTING, UNLOAD THE CARGO BED, LOCK THE BRAKES AND CHOCK THE WHEELS THAT REMAIN ON THE FLOOR. USE A SUITABLE LIFTING DEVICE (CHAIN HOIST OR HYDRAULIC FLOOR JACK) WITH 1000 LB. (454 KG.) MINIMUM LIFTING CAPACITY. DO NOT USE LIFTING DEVICE TO HOLD VEHICLE IN RAISED POSITION. ALWAYS USE APPROVED JACKSTANDS OF PROPER WEIGHT CAPACITY TO SUPPORT THE VEHICLE.
 - 2.1. Disconnect the batteries, negative cable first (Figure 11-1, Page 11-2) and discharge the controller as instructed in the WARNING on page 11-1. Remove the 6 gauge white wire from the A2 motor terminal and secure wire so it will not make contact with any live components or connections. Reconnect batteries, positive cable first (Figure 11-1, Page 11-2).
 - 2.2. Place Forward/Reverse handle in either FORWARD or REVERSE, turn key to ON, and depress accelerator pedal until limit switches activate. This should cause solenoid to operate with an audible click.
 - 2.3. Connect multimeter (set to 200 volts DC) across solenoid small activating posts. Multimeter should read full battery voltage when accelerator is depressed to the floor.
- 3. Check for controller input voltage.
 - 3.1. Remove the 18 gauge red wire from controller input terminal 1.
 - 3.2. Place Forward/Reverse handle in either FORWARD or REVERSE, turn key ON, and depress accelerator pedal until limit switches activate. This should cause solenoid to operate with an audible click.
 - 3.3. Place multimeter (set for 200 volts DC) black probe (–) on B– terminal of controller (with 6 gauge black wire attached) and red probe (+) into terminal end of red wire removed from controller terminal 1. Multimeter should indicate full battery voltage with accelerator pedal pressed to floor (Figure 11-28, Page 11-20).
 - 3.4. If the controller input terminal is not getting full battery voltage, then check wire and connections between the solenoid small post and controller 1 terminal. Replace failed parts.
 - 3.5. Disconnect battery wires, negative cable first (Figure 11-1, Page 11-2) and discharge the controller as instructed in the WARNING on page 11-1. Reconnect the 6 gauge white wire to the A2 motor terminal. Reconnect batteries.
- 4. Check for controller output.
 - 4.1. Disconnect battery wires. Remove 6 gauge white wire from A2 motor terminal and secure wire so that it cannot make contact with any live components or connections. Reconnect battery wires.
 - 4.2. Connect the multimeter (set for 200 volts DC) red probe (+) to the controller B+ terminal and the black probe (-) to the controller M- terminal. The multimeter should display approximately 48 volts, which is controller capacitor voltage (Figure 11-29, Page 11-20).
 - 4.3. Turn key switch ON, place Forward/Reverse handle in FORWARD and watch multimeter as you depress the accelerator pedal. With the accelerator pedal fully depressed, the multimeter should indicate full battery voltage. If the multimeter reading does not rise to full battery voltage (with a properly functioning potentiometer and correct pedal adjustment), then the controller has failed.
 - 4.4. Discharge the controller as instructed in WARNING on page 11-1. Attach the 6 gauge white wire to the A2 motor terminal. Reconnect batteries, positive cable first (Figure 11-1, Page 11-2).

For 48-Volt vehicles excluding the DS:

5. Check for diode.

Test Procedure 10, Continued:

- 5.1. Disconnect battery wires as shown (Figure 11-1, Page 11-2) and discharge controller as instructed in WARNING on page 11-1.
- 5.2. Using two wrenches to keep the posts from turning, remove wires from controller B+ terminal.
- 5.3. Use a multimeter (set to Diode) to test the resistance between the controller A2 and B+ terminals. This test is for the presence of a functioning diode inside the controller. If the diode is shorted either open or closed, the controller has failed. With the black (–) probe on the B+ terminal and the red (+) probe on the A2 terminal, reading should indicate continuity. Reverse leads and reading should indicate no continuity.
- 5.4. Reconnect wires to controller B+ terminal. Reconnect batteries, positive cable first (Figure 11-1, Page 11-2).

Test Procedure 11-Onboard Computer Lockout Circuit

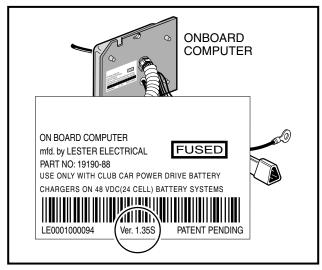
Read DANGER and WARNING on page 11-1.

For vehicles with charger receptacles, follow step 1.

1. Inspect the charger receptacle for water in the contacts. If water is found, proceed as follows:

NOTE

- IF BATTERY PACK IS WET, MAKE SURE 18 GAUGE GRAY WIRE FROM OBC IS NOT TOUCHING BATTERIES. WIRE TIE THE 18 GAUGE GRAY LEAD AND 18 GAUGE GRAY WIRE TO WIRE HARNESS IF NECESSARY.
 - 1.1. Disconnect the batteries, negative cable first, as shown (Figure 11-1, Page 11-2).
 - 1.2. Discharge the controller. See instructions in the WARNING on page 11-1.
 - 1.3. Remove the receptacle from the vehicle. See Section 12-Electrical Components.
 - 1.4. Dry the receptacle by wiping it with a clean dry cloth and by blowing into contacts with compressed air.
 - 1.5. Reinstall the charger receptacle.



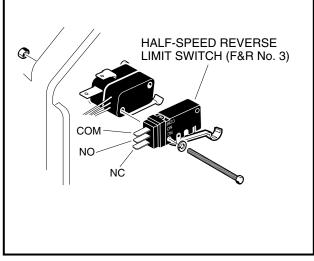


Figure 11-30 OBC V 1.35S

Figure 11-31 F&R Limit Switch

2. With batteries disconnected, inspect the sense lead fuse in the gray wire from OBC. Using a multimeter (set to 200 Ω), check fuse for continuity. If continuity is present, fuse is good. If no continuity is present, the fuse is blown and must be replaced.

- 3. With batteries still disconnected, inspect the wire terminals. Make sure wire terminals are not touching corresponding solenoid terminal posts. Reconnect battery cables and attempt to drive the vehicle.
- 4. If vehicle cannot be driven, disconnect battery cables and solenoid. Remove and replace solenoid diode. See Diode Removal, Section 12–Electrical Components, Page 12-10. Reconnect solenoid, (making sure wires are correctly positioned) reconnect battery cables and attempt to drive the vehicle. If vehicle still does not respond, proceed to step 5.
- 5. Bypass the OBC solenoid lockout circuit to isolate the problem. Use the following procedure:
 - 5.1. Make sure the batteries are disconnected as shown (Figure 11-1, Page 11-2) and the controller has been discharged. See instructions in the WARNING on page 11-1.
 - 5.2. Connect one end of a jumper wire to the small (coil) post of the solenoid (with 18 gauge yellow wire attached). Connect the other end of the jumper wire to the negative post of battery No. 6.
 - 5.3. Reconnect the batteries, positive cable first, and tighten terminals to 110 in-lb (12.4 N-m).
 - 5.4. If vehicle can be driven with jumper wire attached, then OBC has failed and must be replaced. If vehicle cannot be driven with jumper wire attached, then refer to the Troubleshooting Guide on pages 11-9 through 11-11.

Test Procedure 12–Half-Speed Reverse Limit Switch (F&R Limit Switch No. 3) Read DANGER and WARNING on page 11-1.

- 1. With batteries disconnected, check for proper wiring and tight connections.
- 2. Using a multimeter set to 200 Ω (ohms), check continuity across common (COM) and normally open (NO); and across common (COM) and normally closed (NC) (Figures 11-31 and 11-32, Pages 11-22 and 11-23). With the limit switch lever up (not depressed), readings should be:

COM to NC: Zero (or continuity tester is illuminated)

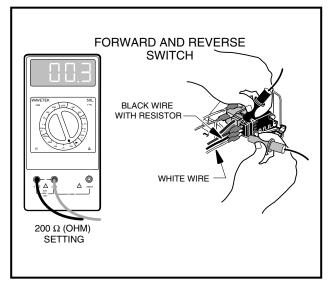
COM to NO: Infinity (or continuity tester is not illuminated)

With the limit switch lever depressed, readings should be:

COM to NC: Infinity (or continuity tester is not illuminated)

COM to NO: Zero (or continuity tester is illuminated)

3. If meter readings are not correct, replace limit switch.





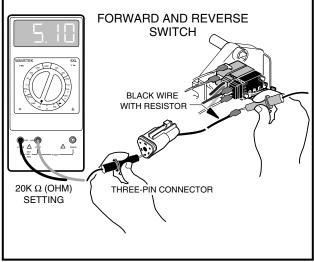


Figure 11-33 Half-Speed Reverse Resistor Test

Test Procedure 13–Half-Speed Reverse Resistor Read DANGER and WARNING on page 11-1.

- 1. Disconnect the batteries (negative cable first) and then disconnect black lead from half-speed reverse limit switch located on Forward/Reverse switch (Figure 11-33, Page 11-23).
- 2. Measure resistance.

Vehicles with Multi-step Potentiometer:

- 2.1. Disconnect the three-pin connector (which connects the multi-step potentiometer to the Forward/ Reverse wire harness) (Figure 11-2, Page 11-3 or Figure 11-3, Page 11-4).
- 2.2. With multimeter set to 20K Ω (ohms), measure resistance through 18 gauge black wire from Forward/Reverse wire harness (at disconnect from three-pin connector) to end disconnected from Half-speed Reverse Limit Switch. Resistance should measure approximately 5100 Ω (ohms) ($\pm 10\%$) (Figure 11-33, Page 11-23).

Vehicles with Continuously Variable Potentiometer:

- 2.1. Disconnect the three-pin connector (connects the potentiometer to the Forward/Reverse wire harness) from the Forward/Reverse wire harness. The connector emerges from under the front body floorboard (Figure 11-27, Page 11-19).
- 2.2. With a multimeter set to 20K Ω (ohms), measure the resistance through the 18 gauge black wire from the Forward/Reverse wire harness (at disconnect from three-pin connector) to the end disconnected from the Half-speed Reverse Limit Switch. Resistance should measure approximately 5100 Ω (ohms) ($\pm 10\%$).
- 3. If the meter reading is not correct, replace the wire assembly to the limit switch.

Test Procedure 14–Reverse Buzzer Limit Switch Read DANGER and WARNING on page 11-1.

- 1. Disconnect the battery cables (negative cable first) and then disconnect red/white wire and orange wire from limit switch located on the F&R switch assembly.
- Connect black (-) probe of a multimeter to top terminal of limit switch and connect red (+) probe to the middle (NO) terminal. With the F&R handle in NEUTRAL or FORWARD reading should be no continuity. Place the F&R handle in REVERSE and reading should be continuity. If readings are not correct replace limit switch.

Test Procedure 15-Reverse Buzzer

Read DANGER and WARNING on page 11-1.

With the batteries connected, use the flow chart (Figure 11-34, Page 11-25) as a starting point for trouble-shooting the reverse buzzer circuit.

Testing the Reverse Buzzer Wire Connections

1. Before checking wire connections, make sure batteries are disconnected. The red 18 gauge wire should be connected to the (+) terminal of the reverse buzzer. The orange 18 gauge wire should be connected to the (-) terminal on the reverse buzzer.

Testing the Front Mounted Reverse Buzzer Circuit

NOTE

• BATTERIES SHOULD REMAIN CONNECTED FOR THIS TEST.

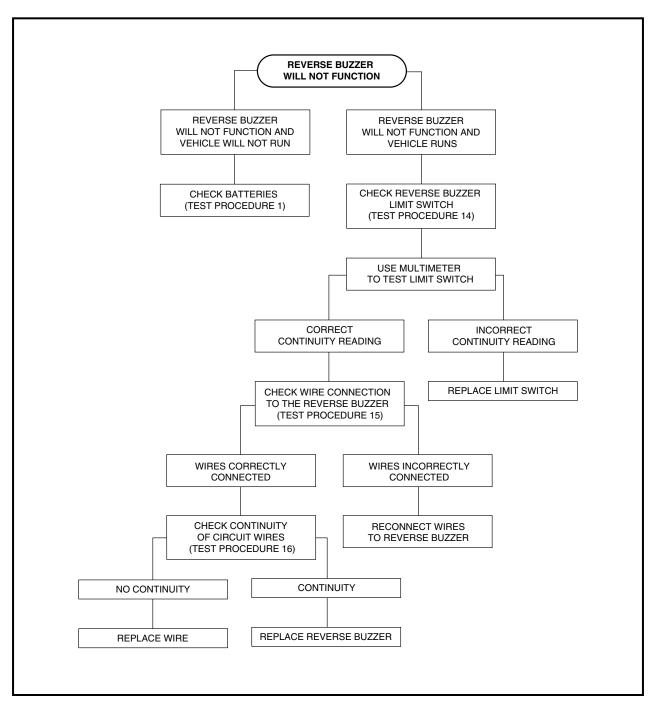


Figure 11-34 Reverse Buzzer Will Not Function

- Disconnect the red/white wire from F&R limit switch No. 2 and place the black probe of a multimeter (set to 200 volts DC) on the wire. Place the red probe of the multimeter on the positive post of battery No. 1. The multimeter should register battery voltage. If it does not, replace the red/white wire.
- 2. Disconnect both wires from F&R limit switch No. 2 and place the probes of a continuity tester on the wire terminals of the limit switch. With the limit switch lever down (open circuit), the tester light should not illuminate. With the limit switch lever up (closed circuit), the tester light should illuminate. If tester light does not illuminate (with the limit switch up), replace the limit switch. If the tester light illuminates, replace the reverse buzzer.

Testing the Rear Mounted Reverse Buzzer Circuit (Carryall 6, Villager 6 and 8 and TransPorter vehicles)

- Disconnect the batteries (Figure 11-1, Page 11-2) and discharge the speed controller. See WARNING on Page 11-1.
- 4. **Carryall 6 Vehicles:** Remove two bed hold-down bolts that secure the bed to the vehicle frame. Raise bed and secure prop rod to bed frame.
- 5. Disconnect the orange wire from the reverse buzzer and from the F&R limit switch No. 2. Place the red (+) probe of a continuity tester on the orange wire at the F&R limit switch end. Place the black (–) probe on the orange wire at the reverse buzzer end. The continuity tester light should illuminate. If it does not, replace the orange wire.
- 6. Disconnect the red wire from the reverse buzzer. Place the red (+) probe of a continuity tester on the red wire and place the black (-) probe on the large post (with 6 gauge red wire attached) of the solenoid. If the tester light does not illuminate, replace the red wire. If the tester light does illuminate, replace the buzzer.

Test Procedure 16–Wire Continuity

Read DANGER and WARNING on page 11-1.

 Disconnect the battery cables (negative cable first) and then disconnect one end of the wire to be tested and connect probe of multimeter to each end of the wire. Multimeter should indicate continuity. If reading is incorrect, repair or replace wire.

Test Procedure 17–Battery Warning Light

- 1. Turn key switch OFF and place the Forward/Reverse handle in NEUTRAL. Leave battery cables connected.
- 2. Disconnect the 18 gauge brown wire from the onboard computer at the three-pin connector (located near the onboard computer).
- 3. Connect one end of a jumper wire to the brown wire that was removed from the three-pin connector, and connect the other end of the jumper wire to the negative (–) post of battery No. 1. The battery warning light should illuminate. If it does not, proceed to step 4.
- 4. Remove the center dash. See step 3 of Key Switch Removal in Section 12 on Page 12-2.
- 5. Disconnect the spade connector on the 18 gauge brown wire from the battery warning light.
- 6. Set the multimeter to 200Ω (ohms) and connect the black (–) probe to the male side of the brown wire spade connector. Connect the red (+) probe to the brown wire female spade. The multimeter should register continuity. If reading is incorrect, repair or replace the wire.
- 7. Disconnect the 18 gauge orange/white wire from the battery warning light at the key switch.
- 8. Set the multimeter to 200 Ω (ohms), connect the black (–) probe to the ring terminal connector on the orange/white wire and connect the red (+) probe to the key switch terminal where the orange/white wire was removed. The multimeter should register continuity. If the reading is incorrect, repair or replace the wire.
- 9. If both wires test operational, then replace the battery warning light.

Test Procedure 18–Voltage at Charger Receptacle Red Wire Socket Read DANGER and WARNING on page 11-1.

- Using a multimeter set to 200 volts DC, place the black lead on the negative post of battery No. 6 and place the
 red lead on the charger receptacle socket connected to the red 10 gauge wire. The reading should be 48-50
 volts (full battery voltage).
- If the reading is zero volts, check the continuity of the 10 gauge red wire from the positive post of battery No. 1 to the receptacle socket.

THE COMMUNICATION DISPLAY MODULE (CDM)

The CDM can be used to retrieve from the onboard computer four important items of information that can be useful in troubleshooting an electric vehicle with PowerDrive System 48. To access one of these items, the item's corresponding Function Code must be selected on the CDM. This is done by pressing the Function Button until the desired function code is displayed in the window. **See Figure 11-35, Page 11-27 for CDM features**. Releasing the button when the desired code is displayed will display the data. Function codes and corresponding data are as follows:

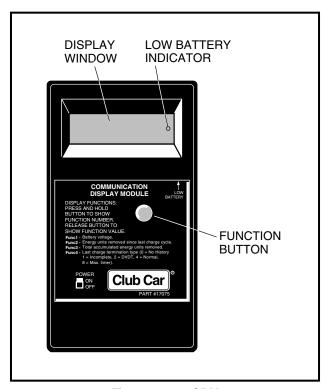


Figure 11-35 CDM

• F1 – Battery voltage:

This displays the battery pack's current state of charge. A reading of less than 48 volts indicates the batteries need to be charged. If a reading of less than 48 volts is obtained immediately after a charge cycle, there may be a problem in the charge circuit.

• F2 – Energy units removed since last charge cycle:

If the display reads over 75 (the vehicle Battery Warning Light should be illuminated), the vehicle batteries need to be recharged before being used again. This data can be used to make sure all vehicles in a fleet receive equal usage on a short term basis.

F3 – Total accumulated energy units removed since initial vehicle start-up:

This information is most useful in making sure that all vehicles in a fleet receive equal usage over long periods of time.

F4 – Last charge termination type (1 = incomplete, 2 = DVDT, 4 = normal, 8 = max. timer):

A 1, 2, 4, or 8 will be displayed.

CDM, Continued:

- 1 Indicates the last charge cycle was incomplete and the batteries were not fully charged. Batteries should be charged again at the earliest opportunity.
- 2 Indicates a back-up charge program was employed by the OBC to complete the charge cycle. A DVDT charge may be displayed the first few times a new set of batteries is charged, and the first time a set of batteries is charged after the batteries have been disconnected and reconnected. A problem may exist if persistent DVDT readings are obtained.
- 4 Indicates the last charge cycle was normal.
- **8** Indicates the charger ran for sixteen hours and shut itself off without completing the charge cycle. This means there may be a problem in the charge circuit.

The CDM also has a low battery indicator which illuminates when CDM batteries are weak and need to be replaced. Weak batteries in the CDM may cause CDM to register inaccurate information or no information.

USING THE CDM TO RETRIEVE DATA FROM THE ONBOARD COMPUTER

- 1. Turn the CDM ON.
- 2. Position the CDM on the seat bottom so it is aligned directly with the battery warning light/LED. Make sure the CDM infra-red LED receiver is pointed at the battery warning light/LED, and there is a clear path between them.

NOTE

- IF, BY POSITIONING CDM ON SEAT BOTTOM CDM IS UNABLE TO COLLECT DATA STREAM FROM OBC, HOLD CDM APPROXIMATELY 6 INCHES FROM THE BATTERY WARNING LIGHT.
- 3. Wait approximately 30 seconds for a value to appear in the display window.
- 4. If a value does not appear in the display window after 30 seconds, try adjusting the aim of the CDM and repeating step 3 until a value appears. If there is still no reading, check for weak batteries in the CDM.

Once a value has been obtained in the display window, the CDM may be removed from its receiving position and the data reviewed. The CDM will hold the values for F1, F2, F3, and F4 until the CDM is turned OFF or it receives another line of data. Use the following procedure to review the data stored in the CDM:

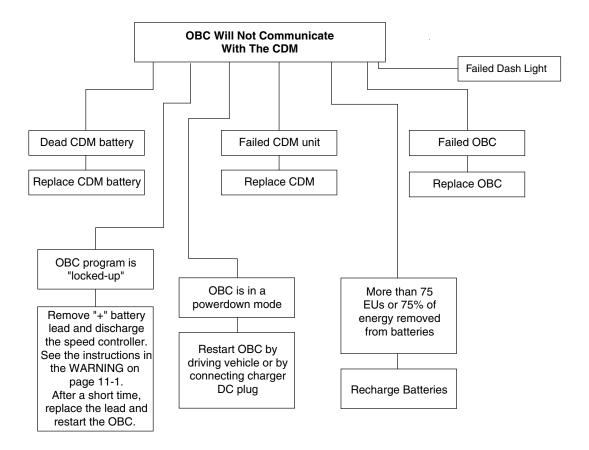
- 1. The value currently displayed will be F1 (battery voltage).
- 2. To view F2, press and hold the button on the CDM. When "Func 2" appears in the display window, release the button. The value for F2 will then be displayed.
- 3. To view F3, press and hold the button on the CDM until "Func 3" appears in the display window. Release the button. The value for F3 will be displayed.
- 4. To view F4, press and hold the button on the CDM until "Func 4" appears in the display window. Release the button. The value for F4 will be displayed.

NOTE

 THE VALUES OF ALL FOUR FUNCTIONS CAN BE RECALLED BY PRESSING AND RELEASING THE CDM BUTTON.

CDM TROUBLESHOOTING GUIDE

Use this chart as a starting point for troubleshooting problems with communications between the CDM and onboard computer. Contact your local Club Car representative for more comprehensive information.



SECTION 12-ELECTRICAL COMPONENTS

A DANGER

- BATTERY EXPLOSIVE GASES! DO NOT SMOKE, KEEP SPARKS AND FLAMES AWAY. VENTILATE WHEN CHARGING OR USING IN AN ENCLOSED SPACE. ALWAYS WEAR FULL FACE SHIELD AND RUBBER GLOVES WHEN WORKING ON OR NEAR BATTERIES.
- USE EXTREME CAUTION WHEN USING TOOLS, WIRES, OR METAL OBJECTS NEAR BATTERIES! A SHORT CIRCUIT AND (OR) SPARK COULD CAUSE AN EXPLOSION.
- BATTERY POISON! CONTAINS ACID! CAUSES SEVERE BURNS. AVOID CONTACT WITH SKIN, EYES, OR CLOTHING. ANTIDOTES:
 - EXTERNAL: FLUSH WITH WATER. CALL A PHYSICIAN IMMEDIATELY.
 - INTERNAL: DRINK LARGE QUANTITIES OF MILK OR WATER. FOLLOW WITH MILK OF MAGNESIA OR VEGETABLE OIL. CALL A PHYSICIAN IMMEDIATELY.
 - EYES: FLUSH WITH WATER FOR FIFTEEN MINUTES. CALL PHYSICIAN IMMEDIATELY.

A WARNING

- ONLY TRAINED TECHNICIANS SHOULD REPAIR OR SERVICE THIS VEHICLE. ANYONE DOING EVEN SIMPLE REPAIRS OR SERVICE SHOULD HAVE KNOWLEDGE AND EXPERIENCE IN ELECTRICAL AND MECHANICAL REPAIR.
- FOLLOW ALL PROCEDURES EXACTLY AS STATED IN THIS MANUAL, AND HEED ALL DANGER, WARNING AND CAUTION STATEMENTS, AS WELL AS THOSE AFFIXED TO THE VEHICLE.
- WEAR SAFETY GLASSES OR APPROVED EYE PROTECTION WHILE SERVICING VEHICLE.
- TURN KEY SWITCH OFF, PLACE FORWARD/REVERSE HANDLE IN THE NEUTRAL POSITION, AND REMOVE KEY PRIOR TO SERVICING.
- DO NOT WEAR LOOSE CLOTHING. REMOVE JEWELRY SUCH AS RINGS, WATCHES, CHAINS, ETC. BEFORE SERVICING VEHICLE.
- USE INSULATED TOOLS WHEN WORKING NEAR BATTERIES OR ELECTRICAL CONNECTIONS. USE EXTREME CAUTION TO AVOID SHORTING OF COMPONENTS OR WIRING.
- TO AVOID UNINTENTIONALLY STARTING THE VEHICLE. DISCONNECT BATTERIES AS SHOWN. IN FIGURE 12-1, PAGE 12-2 AND THEN DISCHARGE THE CONTROLLER AS FOLLOWS:
 - TURN THE KEY SWITCH TO ON AND PLACE THE FORWARD/REVERSE HANDLE IN THE **REVERSE POSITION.**
 - SLOWLY DEPRESS THE ACCELERATOR PEDAL AND KEEP IT DEPRESSED UNTIL THE REVERSE WARNING BUZZER CAN NO LONGER BE HEARD. WHEN THE BUZZER STOPS SOUNDING, THE CONTROLLER IS DISCHARGED.

A CAUTION

 IF WIRES ARE REMOVED OR REPLACED MAKE SURE WIRING AND/OR WIRING HARNESS IS PROPERLY ROUTED AND SECURED TO VEHICLE FRAME. FAILURE TO PROPERLY ROUTE AND SECURE WIRING COULD RESULT IN VEHICLE MALFUNCTION, PROPERTY DAMAGE OR PERSONAL INJURY.

ELECTRICAL COMPONENTS Key Switch

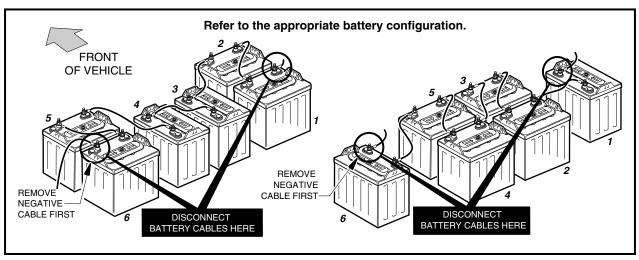


Figure 12-1 Battery Configuration

KEY SWITCH

Read DANGER and WARNING on page 12-1.

The key switch is mounted next to the steering column on the center dash panel.

Testing the Key Switch

See Section 11, Test Procedure 2, Page 11-13.

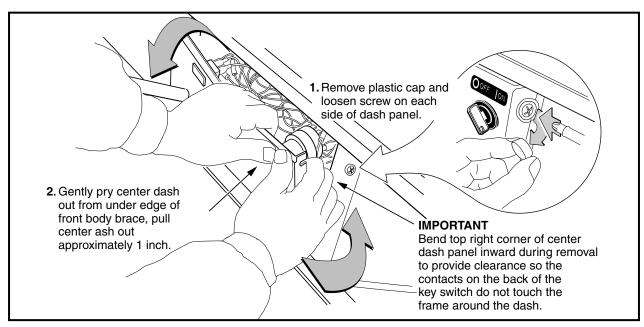


Figure 12-2 Dash removal

Key Switch Removal

- 1. Disconnect batteries (Figure 12-1, Page 12-2).
- 2. Discharge the speed controller. See instructions in WARNING on Page 12-1.
- 3. Remove center dash.
 - 3.1. Remove the plastic cap covering the screw on each side of the center dash.

- 3.2. Loosen (but do not remove) the screw on each side of the center dash panel.
- 3.3. Insert screwdriver at top center of center dash between dash and cowl brace. Gently pry center dash out slightly from under edge of cowl brace.

3.4. Pull center dash out approximately one inch from the frame and then bend the top right corner of the center dash panel inward while pulling the top of the panel out and down (Figure 12-2, Page 12-2). See following NOTE.

NOTE

- BENDING THE TOP RIGHT CORNER OF THE CENTER DASH INWARD DURING REMOVAL WILL PREVENT THE CONTACTS ON THE BACK OF THE KEY SWITCH FROM TOUCHING THE METAL FRAME AROUND THE DASH.
- 4. Slide center dash panel up steering column by snapping top out and then rotating the panel out and up.
- 5. Disconnect the wires from the key switch. Do not allow wires to touch.
- 6. From the back of the dash panel, push down on the retaining tabs surrounding the key switch (4) and remove the key switch cap (8). Hold the key switch and remove the switch retaining nut (6) from the outside of the dash panel (Figure 12-3, Page 12-3).

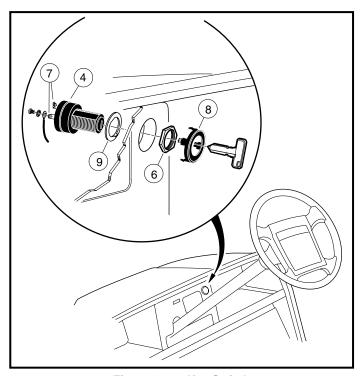


Figure 12-3 Key Switch

Key Switch Installation

- 1. Position the key switch and flat washer (9) in the center dash, then install and tighten the switch retaining nut (6) to 40 in-lb (4.5 N-m). Install key switch cap (8) in center dash (Figure 12-3, Page 12-3).
- Connect the wires to the key switch terminals and tighten the terminal screws to 7 in-lb (.8 N-m). See Section 11, Figures 11-2 through 11-6, Pages 11-3 through 11-7. Coat the terminals with Battery Protector Spray (Club Car Part No. 1014305).
- 3. Install the center dash into the vehicle by reversing the removal procedure. Make sure the key switch terminals (7) do not touch the frame and that the center dash panel is properly seated and snapped into place.

FORWARD/REVERSE (F&R) SWITCH

Read DANGER and WARNING on page 12-1.

A DANGER

• TURN THE KEY TO OFF, PUT THE FORWARD/REVERSE HANDLE IN NEUTRAL, DISCONNECT THE BATTERY CABLES AS SHOWN IN FIGURE 12-1, PAGE 12-2 AND DISCHARGE THE CONTROLLER (SEE WARNING ON PAGE 12-1). FAILURE TO DO SO MAY CAUSE THE VEHICLE TO RUN OVER YOU, RESULTING IN SEVERE INJURY OR DEATH.

Testing the F&R Switch

See Section 11, Test Procedure 6, Page 11-17.

F&R Switch Inspection

Visually inspect rotor and contacts; be sure contacts are in good condition. If they are not, replace the F&R switch. If the switch is hard to turn or sticks, a light spray of WD-40® may be applied to the contacts and shaft. **See following WARNING**. If severe arcing has occurred, check F&R anti-arcing limit switch for proper operation. **See Section 11, Test Procedure 3, Page 11-14**.

WARNING

• **DO NOT** GREASE CONTACTS. THIS COULD CAUSE THE FORWARD/REVERSE SWITCH TO MALFUNCTION OR BURN.

F&R Switch Removal

- 1. Disconnect batteries (Figure 12-1, Page 12-2).
- 2. Remove the Forward/Reverse handle mounting screw (3) and handle (2) (Figure 12-4, Page 12-5).
- 3. Disconnect 18 gauge wires from limit switches. Remove two 6 gauge wires from back of F&R switch.
- 4. Remove the screws (4), plastic washers (6) (if present) and nuts (5) that mount the F&R switch to the body (Figure 12-4, Page 12-5).
- 5. Pull the F&R switch away from the body. Remove the 6 gauge wires from the front of the F&R switch and then remove switch from the battery compartment for ease of service.

F&R Switch Installation

- Connect the 6 gauge wires to the front of the F&R switch and tighten nuts to 45 in-lb (5.1 N-m). See following WARNING.
- 2. Secure F&R switch to vehicle body by using existing hardware and tighten screws to 33 in-lb (3.7 N-m).
- 3. Connect the two 6 gauge wires to the back of the F&R switch and tighten the screws to 27 in-lb (3.0 N-m).
- 4. Reconnect 18 gauge wires to limit switches. See following WARNING and CAUTION.
- 5. Place handle (2) on the F&R switch. Tighten screw (3) to 14 in-lb (1.6 N-m) (Figure 12-4, Page 12-5)

A WARNING

 MAKE SURE WIRES ARE PROPERLY CONNECTED TO F&R SWITCH. IF WIRES ARE NOT PROPERLY CONNECTED, THE VEHICLE MAY OPERATE IN AN UNEXPECTED MANNER, RESULTING IN PROPERTY DAMAGE, SEVERE INJURY OR DEATH. SEE SECTION 11, WIRING DIAGRAMS, FOR APPROPRIATE WIRING CONFIGURATION.

A CAUTION

• BE SURE THE WIRES ARE ROUTED SO THE WIRE FROM THE FORWARD/REVERSE ROTOR DOES NOT PULL ON OTHER WIRES WHEN THE FORWARD/REVERSE HANDLE IS SHIFTED.

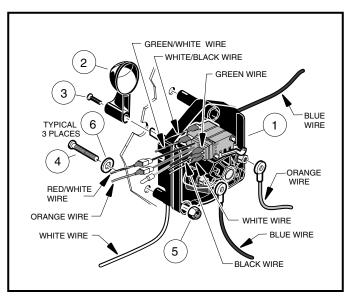


Figure 12-4 F&R Switch Wiring

F&R LIMIT SWITCHES

The F&R anti-arcing limit switch, reverse buzzer limit switch, and half-speed reverse limit switch are located on the F&R switch and are activated by a cam on the F&R switch rotor (Figure 12-5, Page 12-6).

Testing the Limit Switches

- 1. F&R Anti-Arcing Limit Switch: See Section 11, Test Procedure 3, Page 11-14.
- 2. Reverse Buzzer Limit Switch: See Testing Front Mounted Reverse Buzzer Circuit, Page 12-8.
- 3. Half-Speed Reverse Limit Switch: See Section 11, Test Procedure 12, Page 11-23.

Limit Switch Removal

- 1. Disconnect the batteries (Figure 12-1, Page 12-2).
- 2. Remove all three limit switches from F&R switch by removing two screws (5), lock washers (4) and nuts (3). Label each wire prior to disconnecting wire terminals from each switch (Figure 12-5, Page 12-6).

Limit Switch Installation

Install in reverse order of disassembly. Insert labeled wires onto limit switch terminals as designated. Tighten screws to 5 in-lb (0.6 N-m). (If wires were not labeled during removal, see Section 11, Figures 11-2 through 11-8, Pages 11-3 through 11-7, for proper wiring).

After installation, be sure when the rotor is turned, the actuator arm of each switch is pressed and released per chart on next page. If not correct, inspect the Forward/Reverse rotor and limit switches for damage.

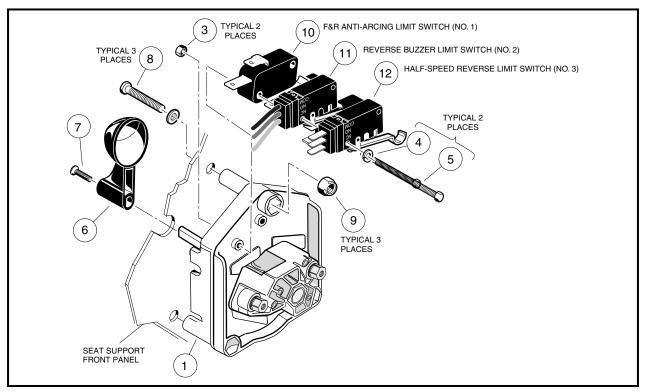


Figure 12-5 Forward/Reverse Switch

LIMIT SWITCH	FORWARD/REVERSE HANDLE POSITION					
	FORWARD	REVERSE				
Forward/Reverse Anti-arcing	Depressed	Depressed				
Half-speed Reverse	Released	Depressed				
Reverse Buzzer	Released	Depressed				

HALF-SPEED RESISTOR - (TO HALF-SPEED REVERSE LIMIT SWITCH)

The half-speed resistor assembly is connected to the half-speed reverse limit switch on the Forward/Reverse switch (Figure 12-5, Page 12-6).

Testing the Half-speed Reverse Resistor

See Section 11, Test Procedure 13, Page 11-24.

Half-speed Resistor Removal

- 1. Disconnect the batteries (Figure 12-1, Page 12-2).
- 2. Disconnect the black and white wires on the No. 3 limit switch (Figure 12-5, Page 12-6).
- 3. Cut electrical tape at both ends of wire conduit and pull wire assembly with resistor out of wire conduit.
- 4. Using an 1/8 inch tip flat blade screwdriver, remove the rubber gasket from the plug housing (Figure 12-6, Page 12-7).
- 5. Place the flat blade of the screwdriver against the wedge lock at the recessed area and pry wedge lock from plug housing (Figure 12-6, Page 12-7).
- 6. Insert screwdriver into terminal under the clip and gently raise the clip and pull wire from housing (Figure 12-6, Page 12-7).

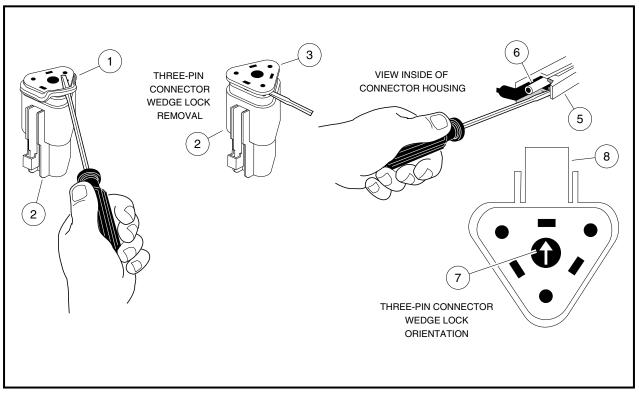


Figure 12-6 Terminal Plug Housing

Half-speed Resistor Installation

- 1. Installation is reverse of removal. Make sure black/white wire is pushed securely into terminal plug housing and locked into place.
- 2. If using a three-pin connector, make sure wedge lock is positioned correctly with arrow on wedge lock pointing toward housing clip (Figure 12-6, Page 12-7).

Accelerator Adjustment - See Section 5–Accelerator and Brake Pedal in the appropriate Maintenance and Service Manual.

ACCELERATOR PEDAL LIMIT SWITCH

Read DANGER and WARNING on page 12-1.

Testing the Accelerator Pedal Limit Switch

See Test Procedure 4, Section 11, Page 11-14.

Accelerator Pedal Limit Switch Removal

- 1. Disconnect batteries (negative cable first) (Figure 12-1, Page 12-2) and discharge speed controller.
- 2. Remove the No. 5 and No. 6 batteries from the vehicle.
- 3. Remove the cover from the wiper switch housing.
- 4. Disconnect the accelerator rod from the ball stud on the wiper switch.
- 5. Remove and retain the screws, lock washers, and nuts attaching the limit switch to the wiper switch.
- 6. Disconnect the green/white and blue wires from the limit switch.

ELECTRICAL COMPONENTS Reverse Buzzer

Accelerator Pedal Limit Switch Installation

1. Position the Accelerator Pedal Limit switch on the wiper switch body and install the mounting screws, lock washers, and nuts. Tighten the screws to 5 in-lb (0.6 N-m).

- 2. Connect the accelerator rod ball joint to the ball stud on the wiper switch.
- 3. Connect the green/white wire to the normally closed (NC) terminal and the blue wire to the common (COM) terminal of the limit switch. The normally open (NO) terminal should have *no* wire attached.
- 4. Install the cover on the wiper switch (make sure all three tabs snap into place).
- 5. Install and connect the No. 5 and No. 6 batteries, leaving the No. 6 negative (-) post disconnected.
- 6. Connect battery cables to battery No. 1 positive (+) first, then connect cable to battery No. 6 negative (-). Tighten terminals to 110 in-lb (12.4 N-m).

REVERSE BUZZER

Read DANGER and WARNING on page 12-1.

The reverse buzzer is mounted on the back of the center dash panel, under the front body. An additional buzzer is mounted on the rear fender of the Carryall 6 and TransPorter vehicles and on the frame next to the rear fender on Villager 6 and 8 vehicles.

Testing the Reverse Buzzer

See Section 11, Test Procedure 15, Page 11-24.

Front Mounted Reverse Buzzer Removal

- Disconnect the batteries (Figure 12-1, Page 12-2) and discharge the speed controller. See WARNING on Page 12-1.
- 2. Remove center dash. See Remove Center Dash on page 12-2.
- 3. Disconnect the 18 gauge red and orange wires from reverse buzzer.
- 4. Remove the two screws from the reverse buzzer.
- 5. Remove the reverse buzzer from the dash panel.

Rear Mounted Reverse Buzzer Removal - Carryall 6, Villager 6 and 8 and TransPorter

- Disconnect the batteries (Figure 12-1, Page 12-2) and discharge the speed controller. See WARNING on Page 12-1.
- 2. **Carryall 6 and TransPorter vehicles:** Remove two 1/4 inch x 4 inch bolts and nuts that secure bed to frame. Raise bed and secure prop rod in bed frame.
- 3. Disconnect the 18 gauge red and orange wires from the reverse buzzer and remove buzzer from vehicle.

Reverse Buzzer Installation

Install the reverse buzzer in the reverse order of removal. Install red wire to positive (+) terminal and orange wire to negative (–) terminal on buzzer.

SOLENOID

Read DANGER and WARNING on page 12-1.

The solenoid is located on the electrical component mounting plate (Figure 12-7, Page 12-9).

The solenoid has two sets of posts; two 5/16 inch posts (power contact posts) and two small posts or terminals (activating coil connections).

ELECTRICAL COMPONENTS Solenoid

Testing the Solenoid

See Section 11, Test Procedure 7, Page 11-18.

Solenoid Removal

1. Disconnect batteries (Figure 12-1, Page 12-2) and discharge the controller. See instructions in WARNING on Page 12-1.

- 2. Disconnect all wires from solenoid. Remove resistor assembly and diode assembly.
- 3. For DS Vehicles: Remove the two thread rolling screws (10) and remove the solenoid (17) (Figure 12-7, Page 12-9).
- 4. For Turf 1, Carryall 1 and Villager 4 Vehicles: Remove two thread rolling screws (10) and mounting bracket (20) (Figure 12-7, Page 12-9).
- 5. For Turf 2, Carryall 2 and 6, TransPorter, and Villager 6 and 8 Vehicles: Remove two thread rolling screws (10) and remove the solenoid (17) (Figure 12-7, Page 12-9).

Solenoid Installation

- 1. Install the solenoid onto the mounting plate and tighten screws to 50 in-lb (5.7 N-m).
- 2. Connect wires to the solenoid as shown in the wiring diagrams in **Section 11**, **Figures 11-2 through 11-8**, **Pages 11-3 through 11-7**. Tighten hex nut (15) to 19 in-lb (2.1 N-m). Tighten hex nut (5) or flange nut (13) to 60 in-lb (6.7 N-m) (**Figure 12-7**, **Page 12-9**).
- 3. Install the resistor as shown in the appropriate wiring diagram. See Section 11, Figures 11-2 through 11-6, Pages 11-3 through 11-7.
- 4. All Vehicles Except the DS: Install the diode as shown in the appropriate wiring diagram Section 11, Figures 11-2 through 11-6, Pages 11-3 through 11-7.

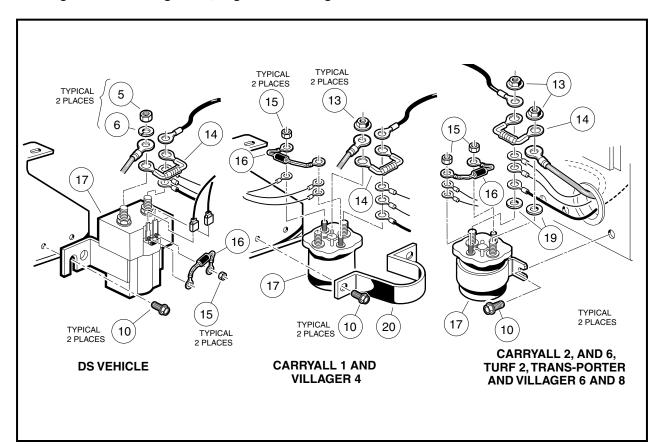


Figure 12-7 Solenoid Removal and Installation

ELECTRICAL COMPONENTS Solenoid

THE DIODE - (SOLENOID)

A diode is placed across the solenoid activating coil to allow the field to collapse and prevent limit switch failures. If limit switches are failing, the diode should be checked.

Testing the Diode

See Section 11, Test Procedure 5, Page 11-15.

Diode Removal

The diode assembly is connected to the two small posts or terminals (activating coil connections) on the solenoid.

- 1. Disconnect batteries (Figure 12-1, Page 12-2).
- 2. Discharge controller. See WARNING on Page 12-1. See also following WARNING.

A WARNING

 FAILURE TO DISCHARGE THE CONTROLLER COULD RESULT IN A SHORT CIRCUIT SHOULD ANY UNINSULATED METAL TOUCH THE LARGE POST DURING REMOVAL OR INSTALLATION OF THE DIODE ASSEMBLY.

All Vehicles Except the DS Electric:

- 3. Remove the two small nuts attaching the diode assembly to the solenoid.
- 4. Remove the diode assembly.

DS Electric Vehicles Only:

- 3. Remove the two small wire terminals from the solenoid.
- 4. Carefully clip the two leads where they attach to the solenoid activating coil terminals.

Diode Installation

All Vehicles Except the DS Electric:

- 1. Install diode assembly onto the small No. 10 solenoid posts.
- 2. Make sure the direction of the diode is correct. The red insulated terminal of the diode assembly should be installed on the same post to which the 18 gauge red wire (with insulated terminal) is attached, and the clear insulated terminal of the diode assembly should be installed on the same post to which the 18 gauge yellow wire is attached. See Section 11, Figures 11-2 through 11-6, Pages 11-3 through 11-7.
- 3. Attach remaining wires to posts as shown in **Section 11**, **Figures 11-2 through 11-6**, **Pages 11-3 through 11-7**. Install and tighten two No.10 nuts to posts. Tighten to 19 in-lb (2.1 N-m).

DS Electric Vehicles Only:

1. Install a new diode assembly (Club Car part No. 1014948), making sure that the red ring terminal of the replacement diode is connected to the positive (+) solenoid terminal.

RESISTOR - (SOLENOID)

A 250 Ω (ohm) resistor is placed across the contacts to keep the capacitors in the solid state speed controller charged. This reduces arcing on the contacts of the solenoid. Whenever a solenoid fails or the 250 Ω (ohm) resistor is discolored or changed in appearance, the resistor should be checked.

Testing the Resistor

See Section 11, Test Procedure 7, Page 11-18.

Resistor Removal

- 1. Disconnect batteries (Figure 12-1, Page 12-2).
- 2. Discharge controller. See instructions in WARNING on Page 12-1. See also preceding WARNING.
- 3. Remove the two large nuts that attach the resistor to the solenoid.
- 4. Remove the resistor from the solenoid.

Resistor Installation

1. Install in reverse order of removal. Tighten large nuts attaching resistor to solenoid to 60 in-lb (6.7 N-m). See Section 11, Figures 11-2 through 11-6, Pages 11-3 through 11-7 for proper wiring.

ONBOARD COMPUTER (OBC)

Read DANGER and WARNING on page 12-1.

Testing the Onboard Computer

See Section 11, Test Procedure 11, Page 11-22.

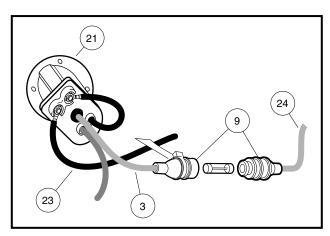


Figure 12-8 Charger Receptacle Wiring

Onboard Computer Removal

- Disconnect batteries (Figure 12-1, Page 12-2).
- 2. Discharge the controller. See WARNING on Page 12-1. See also WARNING on page 12-10.
- 3. Disconnect 10 gauge black wire (23) from the back of charger receptacle (21) (Figure 12-8, Page 12-11).
- 4. Disconnect the gray wire (from OBC) at the fuse housing (9), leaving the sense lead fuse inserted into housing on the gray lead (3) from the charger receptacle (Figure 12-8, Page 12-11).
- 5. Remove the 18 gauge red and yellow wires on the solenoid.
- 6. Disconnect 6 and 10 gauge black wires from B- terminal of the controller (11) (Figure 12-9, Page 12-12 or Figure 12-10, Page 12-12).
- 7. Disconnect the three-pin connector (18) at the OBC (15) (Figure 12-9, Page 12-12 or Figure 12-10, Page 12-12).
- 8. Loosen, but do not remove, two 1/4 thread rolling screws (10) holding OBC to the component mounting plate (1) (Figure 12-9, Page 12-12 or Figure 12-10, Page 12-12).
- 9. Slide the OBC to the left (DS, Turf 1, Carryall 1 and Villager 4 vehicles) and remove OBC from mounting plate.

12 ELECTRICAL COMPONENTS Onboard Computer (OBC)

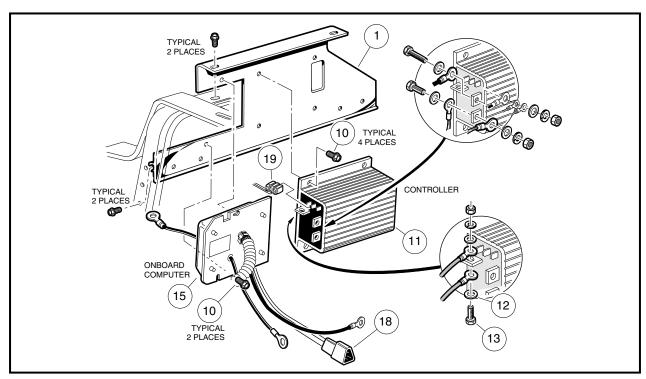


Figure 12-9 Controller and Onboard Computer - DS, Turf 1, Carryall 1 and Villager 4 Vehicles

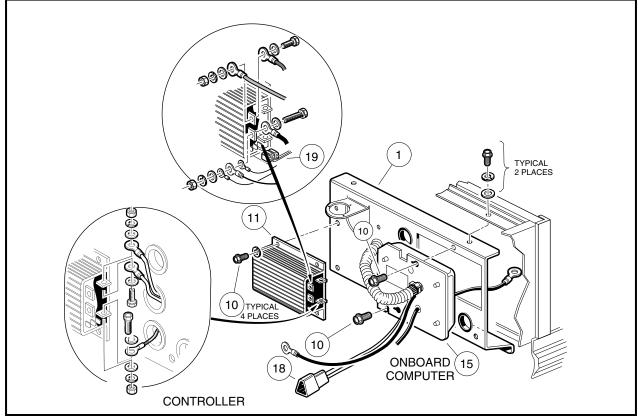


Figure 12-10 Controller and Onboard Computer - Turf 2, Carryall 2 and 6, Villager 6 and 8 and TransPorter Vehicles

Onboard Computer Installation

Install the OBC in reverse order of removal. Tighten 1/4 thread rolling screws to 50 in-lb (5.6 N-m).

SOLID STATE SPEED CONTROLLER

Read DANGER and WARNING on page 12-1.

Testing the Speed Controller

See Section 11, Test Procedure 10, Page 11-20.

Speed Controller Removal

- 1. Disconnect the batteries (Figure 12-1, Page 12-2).
- 2. Discharge the controller. See instructions in WARNING on Page 12-1.
- 3. Remove all 6 gauge wires connected to the controller (11) (Figure 12-9, Page 12-12 or Figure 12-10, Page 12-12).
- 4. Unplug the three 18 gauge wires (19) plugged into the controller (Figure 12-9, Page 12-12 or Figure 12-10, Page 12-12).
- 5. Remove the four 1/4 thread rolling screws (10) holding the controller to the mounting plate (1) (Figure 12-9, Page 12-12 or Figure 12-10, Page 12-12).
- 6. Remove the controller from the vehicle.

Speed Controller Installation

Install in reverse order of disassembly. Tighten 1/4 thread rolling screws (10) holding controller to mounting plate to 50 in-lb (5.6 N-m) (Figure 12-9, Page 12-12 or Figure 12-10, Page 12-12). Connect wires to terminals and tighten to 120 in-lb (13.6 N-m).

CHARGER RECEPTACLE

Read DANGER and WARNING on page 12-1.

DS, Turf 1 and 2, Carryall 1 and 2, and Villager vehicles only

The charger receptacle and DC cord and plug are wear items that should be inspected daily. They *must* be replaced when worn or damaged. If the charger plug and receptacle show signs of corrosion or are becoming difficult to insert and remove, the receptacle contacts and plug blades can be cleaned with a good electrical contact cleaner or lightly sprayed with WD-40[®] brand spray lubricant.

Testing the Charger Receptacle

See Section 14, Test Procedure 1, Page 14-12.

See also Section 11, Test Procedure 18, Page 11-26.

Charger Receptacle Inspection

Inspect the receptacle for cracks, loose connections and frayed wiring.

Charger Receptacle Removal

NOTE

- DISASSEMBLY OF THE CHARGER RECEPTACLE, FOR THE PURPOSE OF REMOVAL OR INSTALLATION, IS NOT RECOMMENDED.
- 1. Disconnect the battery cables, negative cable first (Figure 12-1, Page 12-2) and discharge the speed controller as instructed in the WARNING on page 12-1.

2 ELECTRICAL COMPONENTS Charger Receptacle

Charger Receptacle Removal, Continued:

- 2. Remove the 10 gauge red wire (4) from the positive post of battery No. 1 (Figure 12-11, Page 12-14).
- 3. Remove black 10 gauge OBC wire (5) from charger receptacle assembly (Figure 12-11, Page 12-14).
- 4. Disconnect the gray wire (9) from the receptacle at the yellow fuse holder (Figure 12-11, Page 12-14).
- 5. Remove the four screws (1) that secure the charger receptacle bezel (7) to the receptacle backing plate (8) and to the vehicle body (Figure 12-11, Page 12-14).
- 6. Move the receptacle assembly toward the front of the vehicle and tilt receptacle upwards in order for the receptacle to pass through the hole in the vehicle body.

Charger Receptacle Installation

- 1. Insert the 10 gauge red wire (4) and the 18 gauge gray wire (3) through the hole in the vehicle body and the receptacle backing plate (8) (Figure 12-11, Page 12-14).
- 2. Insert receptacle into vehicle body.
- 3. Install the four screws (1) that secure the receptacle assembly to the vehicle body and receptacle backing plate (8). Tighten screws to 11 in-lb (1.2 N-m) (Figure 12-11, Page 12-14).
- 4. Connect 18 gauge gray wire (9) to yellow fuse holder. Make sure fuse (11) is installed in fuse holder.
- 5. Connect the 10 gauge black wire (5) to the receptacle fuse link (6) on the charger receptacle assembly (Figure 12-11, Page 12-14).
- 6. Connect the 10 gauge red wire (4) to the positive post of battery No. 1.

A WARNING

• DO NOT BY-PASS THE SENSE LEAD FUSE (11) ON THE RECEPTACLE WIRE (3) **(FIGURE 12-11, PAGE 12-14)**.

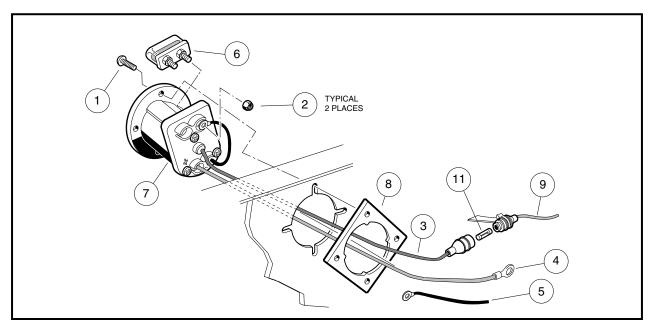


Figure 12-11 Charger Receptacle

RECEPTACLE FUSE LINK

The fuse link on the PowerDrive System 48 vehicle should not blow under normal operating conditions. However, if the fuse link has blown, the vehicle will not charge and the fuse must be replaced. The fuse link is mounted on top of the charger receptacle in the battery compartment. **See DANGER on page 12-1**.

Receptacle Fuse Link Removal

- 1. Remove the fuse link assembly (6) from the charger receptacle (7) by removing the two lock nuts (2) used to secure the 10 gauge black wire (5) from the computer and the 10 gauge black wire to the receptacle (Figure 12-11, Page 12-14).
- 2. Remove the fuse link (6) from the charger receptacle (Figure 12-11, Page 12-14).

Receptacle Fuse Link Installation

- 1. Insert the two fuse link mounting studs into the mounting holes in the charger receptacle.
- 2. Place the two 10 gauge black wires in their original positions on the fuse link mounting posts.
- 3. Install nuts (2) on fuse link mounting posts and tighten to 19 in-lb (2.1 N-m) (Figure 12-11, Page 12-14).

CONTINUOUSLY VARIABLE POTENTIOMETER

Read DANGER and WARNING on page 12-1.

Turf 2, Carryall 2 and 6, TransPorter, and Villager 6 and 8 vehicles only

Testing the Continuously Variable Potentiometer

See Section 11, Test Procedure 9, Page 11-19.

Continuously Variable Potentiometer Removal

- 1. Disconnect batteries (Figure 12-1, Page 12-2).
- 2. Discharge the controller. See WARNING on Page 12-1.

WARNING

- FAILURE TO DISCHARGE THE CONTROLLER COULD RESULT IN A SHORT CIRCUIT IF ANY UNINSULATED METAL COMES INTO CONTACT WITH THE LARGE POST OF THE SOLENOID.
- 3. Remove center dash. See Remove Center Dash on page 12-2.
- 4. Disconnect the 18 gauge blue wire (1) from the key switch (Figure 12-13, Page 12-17).
- 5. Unplug pin connector (2) that connects the potentiometer to the wire harness (Figure 12-13, Page 12-17).
- 6. Disconnect 18 gauge green/white wire (3) at the quick disconnect terminal (Figure 12-13, Page 12-17).
- 7. Remove the potentiometer housing cover (8) by removing two No. 4 screws (9) (Figure 12-13, Page 12-17).
- 8. Remove the 3/8 lock nut (10) at the ratchet (11) (Figure 12-13, Page 12-17).
- 9. Remove the 3/8 bolt (12), two washers, and nut attaching the accelerator pedal (5) to the accelerator pivot rod (7) (Figure 12-13, Page 12-17).
- 10. Remove 1/4 bolt (13) and nut (21) attaching spring retainer (14) to accelerator pivot rod (Figure 12-13, Page 12-17).
- 11. Remove 1/4 bolt (15), washer and nut attaching actuator lever (6) to accelerator pivot rod (Figure 12-13, Page 12-17).
- 12. Remove the pivot rod.

NOTE

- THERE IS A NYLON WASHER (16) BETWEEN THE ACTUATOR LEVER AND THE POTENTIOMETER HOUSING (18) (FIGURE 12-13, PAGE 12-17).
- 13. Remove the four 1/4 inch bolts (17), washers and nuts attaching the potentiometer housing (18) and

the pivot rod support (19) to the frame (Figure 12-13, Page 12-17).

14. Remove the potentiometer housing and pivot rod support from the I-Beam.

Continuously Variable Potentiometer Installation

1. Position the potentiometer housing (18) and pivot rod support (19) on the frame and install the four 1/4 inch bolts (17) with washers and nuts (Figure 12-13, Page 12-17). See following NOTE.

NOTE

- DO NOT TIGHTEN BOLTS AT THIS TIME.
- 2. Install the pivot rod (7), with accelerator pedal (5), actuator lever (6), and nylon washer (16), into the potentiometer housing (Figure 12-13, Page 12-17). See following NOTE.

NOTE

- MAKE SURE THE ACTUATOR LEVER PIN IS INSERTED INTO THE POTENTIOMETER LEVER (SEE FIGURE 12-12, PAGE 12-16).
- 3. Tighten the four 1/4 inch potentiometer housing mounting bolts to 75 in-lb (8.5 N-m).
- 4. Install the spring retainer (14) onto the pivot rod (7) (Figure 12-13, Page 12-17).

A CAUTION

• WHEN REASSEMBLED, THE BOLT (13), BEARING (22), AND NUT (21) MUST BE ORIENTED EXACTLY AS SHOWN (FIGURE 12-13, PAGE 12-17). FAILURE TO DO SO COULD RESULT IN UNEXPECTED VEHICLE ACCELERATION.

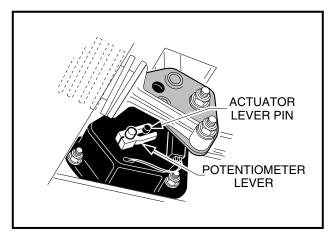


Figure 12-12 Potentiometer Housing

- 5. Position the ratchet (11) on the end of the pivot rod (7) so there is approximately an .060 inch ± .030 inch gap between the pawl and the ratchet teeth (this can be verified with a feeler gauge) (Figure 12-13, Page 12-17).
- 6. Install and tighten nut (10) to 18 ft-lb (24.4 N-m) (Figure 12-13, Page 12-17).
- 7. Connect the 18 gauge blue wire (1) to the key switch (Figure 12-13, Page 12-17).
- 8. Install the center dash panel in reverse order of removal.
- 9. Connect pin connector (2) from potentiometer to lead from wire harness (Figure 12-13, Page 12-17).
- 10. Plug the 18 gauge green/white wire (3) to F&R limit switch No.1 (Figure 12-13, Page 12-17).

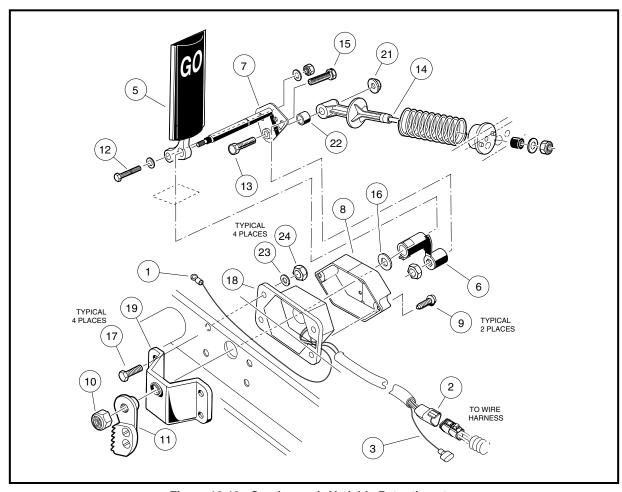


Figure 12-13 Continuously Variable Potentiometer

11. Adjust pedal group per instructions in Section 5-Accelerator and Brake Pedal. See preceding CAUTION.

MULTI-STEP POTENTIOMETER

Read DANGER and WARNING on page 12-1.

DS, Carryall 1, Turf 1 and Villager 4 vehicles only

Testing the Multi-step Potentiometer

See Section 11, Test Procedure 8, Page 11-18.

Multi-step Potentiometer Removal

- 1. Disconnect batteries (Figure 12-1, Page 12-2) and discharge controller. See WARNING on page 12-1.
- 2. Remove the battery wire connecting battery Nos. 5 and 6 and the battery wire connecting battery Nos. 5 and 4 (Figure 12-1, Page 12-2).
- 3. Remove the hold-down bracket from the No. 5 and No. 6 batteries and remove batteries from the vehicle (Figure 12-1, Page 12-2).
- 4. Slide back the ball stud retainer on the potentiometer end of the accelerator rod (1) and disconnect the accelerator rod from the multi-step potentiometer (Figure 12-17, Page 12-22).

12 ELECTRICAL COMPONENTS Multi-Step Potentiometer

Multi-step Potentiometer Removal, Continued:

- 5. Disconnect three-pin connector (2), blue wire and the green/white wire at multi-step potentiometer from the wire harness (Figure 12-17, Page 12-22).
- 6. Remove the nuts (6) and lock washers (7) from underneath the I-Beam and lift the multi-step potentiometer assembly from the frame. Remove the shim plate (8) (Figure 12-17, Page 12-22).

Multi-step Potentiometer Disassembly

- 1. Remove nuts (30) and slide bolt (29) out of potentiometer housing (Figure 12-16, Page 12-21).
- 2. Remove the nut (32) and bell crank (34) (Figure 12-16, Page 12-21).
- 3. Slide the wiper arm assembly out of the housing (1) (Figure 12-16, Page 12-21).
- 4. Disassemble the wiper arm assembly: Unscrew the adjustment screw (23) and retainer nut (19) and remove the spring (21) (Figure 12-16, Page 12-21).
- 5. To remove the bearings (22) (Figure 12-16, Page 12-21) lightly tap them from the back with a punch.

Multi-step Potentiometer Assembly

- 1. Install bearings (22) into the potentiometer housing by lightly tapping them with a plastic hammer. Make sure the collars of the bearings are flush against the housing (Figure 12-16, Page 12-21).
- 2. With spring (21) in place, hold wiper arm (26) and carrier (20) together (Figure 12-16, Page 12-21).

CAUTION

- MAKE SURE THE SPRING IS IN THE RECESSED AREA OF THE WIPER ARM. IF THE SPRING IS NOT IN PLACE, THE WIPER ARM MAY BREAK IF FORCED.
- 3. Install the adjustment screw (23) and a new nylon lock nut (19) (Figure 12-16, Page 12-21).

NOTE

- WIPER ARM SHOULD BE ADJUSTED AFTER THE POTENTIOMETER IS FULLY ASSEMBLED.
- 4. Slide the wiper arm assembly (20) into the potentiometer housing and install the bell crank (34). If ball stud (33) was removed, insert it through the bell crank with ball stud facing down and away from housing and install the nut (35). While holding ball stud with a wrench, tighten the nut to 5 ft-lb (7 N-m) (Figure 12-16, Page 12-21).
- 5. While holding the bell crank so the arm does not exert a load on the housing, install the nut (32) and tighten to 9 ft-lb (12 N-m) (Figure 12-16, Page 12-21).
- 6. Install screw (29), lock washer (9), and nut (30) through potentiometer housing (Figure 12-16, Page 12-21).
- 7. Install nuts (30) and yellow 18 gauge wire (8) onto the screw and tighten to 40 in-lb (4.5 N-m). **See following WARNING.**

A WARNING

- MAKE SURE WIPER ARM ROTATES FREELY IN POTENTIOMETER HOUSING. IF ARM BINDS OR STICKS, IT MUST BE REPLACED.
- 8. Adjust the potentiometer arm. See Page 12-19.

Multi-step Potentiometer Installation

A CAUTION

• BEFORE INSTALLING THE WIPER SWITCH, INSPECT THE HOUSING FOR CRACKS OR DAMAGE. IF THE HOUSING IS DAMAGED, THE ENTIRE HOUSING WITH FIXED CONTACTS MUST BE REPLACED.

- 1. Position shim plate (8) on frame I-Beam with mounting holes aligned (Figure 12-17, Page 12-22).
- 2. Use a flat-blade screwdriver to push the locking tabs out from the retainers, and remove the potentiometer cover (9) (Figure 12-17, Page 12-22).
- 3. Position potentiometer on shim plate and frame. Make sure mounting holes are aligned. Insert mounting bolts (10) through potentiometer base, shim plate, and frame as shown (Figure 12-17, Page 12-22).
- 4. Hold the mounting bolts in place while installing the lock washers (7) and nuts (6). Tighten nuts to 35 in-lb (3.9 N-m) (Figure 12-17, Page 12-22).

A WARNING

- AFTER INSTALLING THE WIPER SWITCH, MAKE SURE IT IS SECURELY FASTENED TO THE VEHICLE FRAME.
- 5. Connect the three-pin connector, blue wire and the green/white wire at the multi-step potentiometer to the wire harness.
- 6. Connect the accelerator rod (1) to the potentiometer (Figure 12-17, Page 12-22).
- 7. Make sure wiper contact is positioned squarely on the last stationary contact when the accelerator pedal is depressed; otherwise, top vehicle speed will not be achieved.
- 8. Make sure the wiper switch and pedal group are properly adjusted. See Section 5–Accelerator and Brake Pedal Group in the appropriate Maintenance and Service Manual.
- 9. Install and connect the No. 5 and No. 6 batteries, leaving the No. 6 negative (–) post disconnected. Tighten terminals to 110 in-lb (12.4 N-m). (Figure 12-1, Page 12-2).
- 10. Reconnect battery cables to battery No. 1 positive (+) first, then connect to battery No. 6 negative (-). Tighten terminals to 110 in-lb (12.4 N-m).
- 11. Drive the vehicle and inspect it for proper operation.

A CAUTION

• DO NOT OPERATE VEHICLE WITHOUT WIPER SWITCH COVER IN PLACE. OPERATING THE VEHICLE WITHOUT THE COVER ALLOWS DIRT, DUST AND WATER TO CONTAMINATE THE WIPER SWITCH, WHICH COULD CAUSE THE SWITCH TO FAIL OR MALFUNCTION.

Multi-step Potentiometer Arm Adjustment

The contact surfaces on the multi-step potentiometer arm brush and fixed contacts must be parallel to ensure efficient operation of the multi-step potentiometer (Figure 12-14, Page 12-20). Adjust arm contact as follows:

- 1. Disconnect battery cables, negative cable first and discharge the controller as instructed in WARNING on page 12-1. Remove the No. 5 and No. 6 batteries from the vehicle (Figure 12-1, Page 12-2) and remove the cover from the multi-step potentiometer.
- 2. Test the multi-step potentiometer arm and fixed contacts for proper adjustment:
 - 2.1. With a dry erase marker, completely coat each of the fixed contacts.

12 ELECTRICAL COMPONENTS Multi-Step Potentiometer

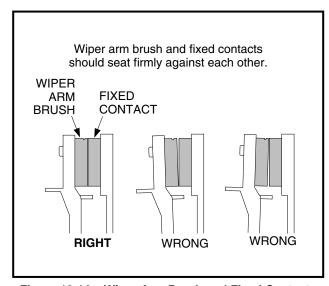
Multi-step Potentiometer Arm Adjustment, Continued:

2.2. Sweep the multi-step potentiometer arm brush back and forth across the fixed contacts. Scraping of the ink should show contact on at least 30% of the surface on each fixed contact. If 30% contact is not shown, surface contact should be adjusted.

 To adjust surface contact, turn the adjustment screw (23) (Figure 12-16, Page 12-21) until surfaces of the multi-step potentiometer arm brush and fixed contacts are parallel (Figure 12-14, Page 12-20).
 See NOTE on page 12-20.

NOTE

- USE OF A LOCKING COMPOUND IS NOT NECESSARY IN CONJUNCTION WITH A NYLON LOCK NUT.
- IF THE MULTI-STEP POTENTIOMETER ARM BRUSH IS WORN TO OR BEYOND THE WEAR LIMIT LINE, IT SHOULD BE REPLACED (FIGURE 12-15, PAGE 12-20). IF ANY OF THE FIXED CONTACTS ARE EXCESSIVELY WORN, PITTED, OR BURNED, THE ENTIRE HOUSING WITH FIXED CONTACTS MUST BE REPLACED.
- A THREAD LOCKING COMPOUND HAS BEEN PLACED ON THE THREADS OF THE CONTACT STUDS TO PREVENT REMOVAL OF THE FIXED CONTACTS.



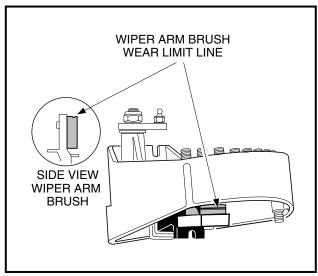


Figure 12-14 Wiper Arm Brush and Fixed Contacts

Figure 12-15 Wiper Arm Brush Wear Limit Line

Multi-step Potentiometer Arm Brush Replacement

- 1. Disconnect the battery cables, negative cable first and discharge the controller as instructed in the WARNING on page 12-1.
- 2. Remove battery Nos. 5 and 6 from the vehicle (Figure 12-1, Page 12-2).
- 3. Disconnect accelerator rod from ball stud and place the wiper switch arm on the topmost fixed contact.
- 4. Remove the nut (30) and lock washer (9) from the bolt (29) and remove the 18 gauge yellow wire (8) (Figure 12-16, Page 12-21).
- 5. Remove the second and third nuts (30) from the bolt (29) and then remove the bolt from the potentiometer housing (1) (Figure 12-16, Page 12-21).
- 6. Remove the fourth nut (30) and wire (42) from the bolt (29) (Figure 12-16, Page 12-21).
- 7. Replace the multi-step potentiometer arm brush (27) as follows (Figure 12-16, Page 12-21).
 - 7.1. Remove screw (25) and lock washer (14). Pull arm assembly away from fixed contacts (Figure 12-16, Page 12-21).

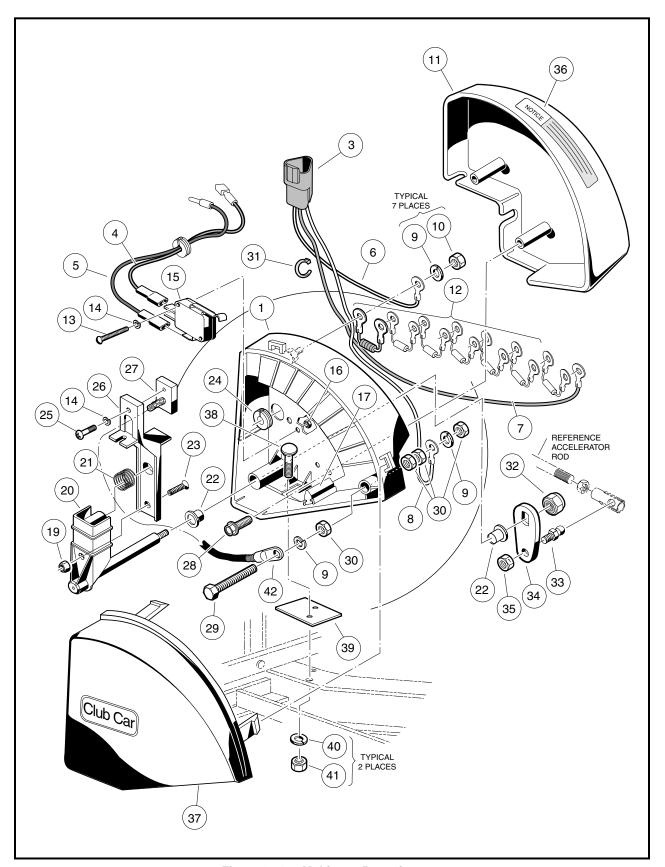


Figure 12-16 Multi-step Potentiometer

12 ELECTRICAL COMPONENTS Multi-Step Potentiometer

Multi-step Potentiometer Arm Brush Replacement, Continued:

- 7.2. Remove the brush by pulling the wire through the hole in the wiper arm.
- 7.3. Install new multi-step potentiometer arm brush assembly (27) (Figure 12-16, Page 12-21).
- 7.4. Install screw (25) and lock washer (14) through wiper arm into brush. Tighten screw to 7 in-lb (0.8 N-m) (Figure 12-16, Page 12-21).
- 8. Install arm brush wire terminal (42) onto the bolt (29) and then install the nut (30). Thread the nut against the arm brush wire terminal and tighten it to 40 in-lb (4.5 N-m) (Figure 12-16, Page 12-21).
- 9. Install the bolt (29) through the potentiometer housing (1) and then install two nuts (30) onto the bolt. Tighten the nuts to 40 in-lb (4.5 N-m) (Figure 12-16, Page 12-21).
- 10. Install the 18 gauge yellow wire onto the bolt (29), then install the lock washer (9) and nut (30). Tighten nut to 40 in-lb (4.5 N-m) (Figure 12-16, Page 12-21).
- 11. Connect the accelerator rod to the ball stud.
- 12. Check multi-step potentiometer arm brush contact for proper adjustment. See Page 12-19.
- 13. Check accelerator and brake pedal adjustment. See Section 5–Accelerator and Brake Pedal Group in the appropriate Maintenance and Service Manual.
- 14. Install potentiometer cover and install No. 5 and 6 batteries, leaving the No.6 negative (–) post disconnected. Tighten terminals to 110 in-lb (12.4 N-m) (Figure 12-1, Page 12-2).
- Reconnect the battery cables to battery No.1 positive (+) first, then connect cable to battery No. 6 negative(-). Tighten terminals to 110 in-lb (12.4 N-m). Coat terminals with Battery Protector Spray (Club Car Part No. 1014305) to minimize corrosion

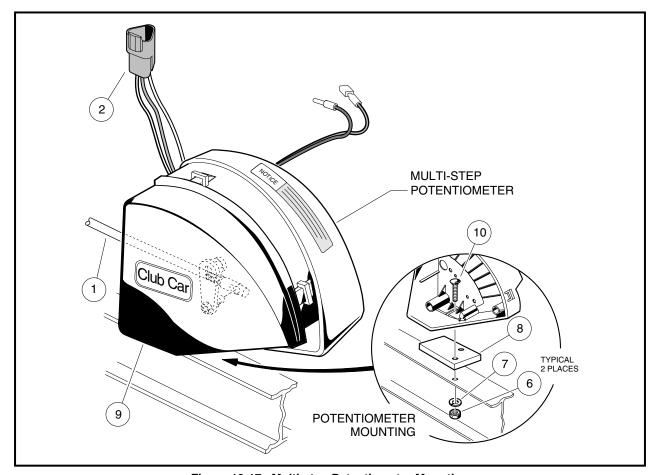


Figure 12-17 Multi-step Potentiometer Mounting

Multi-step Potentiometer Adjustment

Each of the adjustments listed in the following **WARNING** affects multi-step potentiometer adjustment. To ensure proper vehicle operation, if any one item requires adjustment, all must be checked, and adjusted if necessary, in the order listed.

WARNING

- BRAKE PEDAL AND CABLE ADJUSTMENT. SEE SECTION 5-ACCELERATOR AND BRAKE PEDAL GROUP, IN THE APPROPRIATE MAINTENANCE AND SERVICE MANUAL.
- ACCELERATOR ROD ADJUSTMENT. SEE SECTION 5-ACCELERATOR AND BRAKE PEDAL GROUP, IN THE APPROPRIATE MAINTENANCE AND SERVICE MANUAL.
- ACCELERATOR PEDAL STOP ADJUSTMENT. SEE SECTION 5-ACCELERATOR AND BRAKE PEDAL GROUP, IN THE APPROPRIATE MAINTENANCE AND SERVICE MANUAL.
- PARK BRAKE ADJUSTMENT. SEE SECTION 5-ACCELERATOR AND BRAKE PEDAL GROUP, IN THE APPROPRIATE MAINTENANCE AND SERVICE MANUAL.
- FAILURE TO CHECK ALL ADJUSTMENTS IN THE ORDER LISTED COULD RESULT IN IMPROPER VEHICLE OPERATION, PROPERTY DAMAGE, OR SEVERE PERSONAL INJURY.

RESISTORS

Resistor Removal

- 1. Push locking tabs out of the retainers and remove multi-step potentiometer cover (1) (Figure 12-18, Page 12-24).
- 2. Remove two thread-rolling screws and resistor protector cover (39) from the multi-step potentiometer (Figure 12-18, Page 12-24).
- 3. Remove the eight 1/4-20 hex nuts securing the resistors to the multi-step potentiometer.
- 4. Remove the seven resistors from the multi-step potentiometer.

Resistor Installation

- 1. Install the purple wire (24) on the second threaded post (Figure 12-18, Page 12-24).
- 2. Install the zero Ω (ohm) resistor assembly (23) (one black color band) onto the second and third threaded posts (Figure 12-18, Page 12-24).
- 3. Install the 910 Ω (ohm) resistor assembly (26) (color bands white, brown, and gold) onto the third and fourth threaded posts (Figure 12-18, Page 12-24). See following NOTE.

NOTE

- THE COLOR BANDS ON THE RESISTORS DO NOT NEED TO BE ORIENTED IN ANY PARTICULAR DIRECTION WHEN INSTALLED.
- 4. Install the 750 Ω (ohm) resistor assembly (27) (color bands violet, green, brown, and gold) onto the fourth and fifth threaded posts (**Figure 12-18**, **Page 12-24**).
- 5. Install the 910 Ω (ohm) resistor assembly (28) (color bands white, brown and gold) onto the fifth and sixth threaded posts (**Figure 12-18**, **Page 12-24**).
- 6. Install the 1000 Ω (ohm) resistor assembly (29) (color bands brown, black, red, and gold) onto the sixth and seventh threaded posts (Figure 12-18, Page 12-24).
- 7. Install the 1000 Ω (ohm) resistor assembly (30) (color bands brown, black, red, and gold) onto the seventh and eighth threaded posts (**Figure 12-18**, **Page 12-24**).

12 ELECTRICAL COMPONENTS Battery Warning Light

Resistor Installation, Continued:

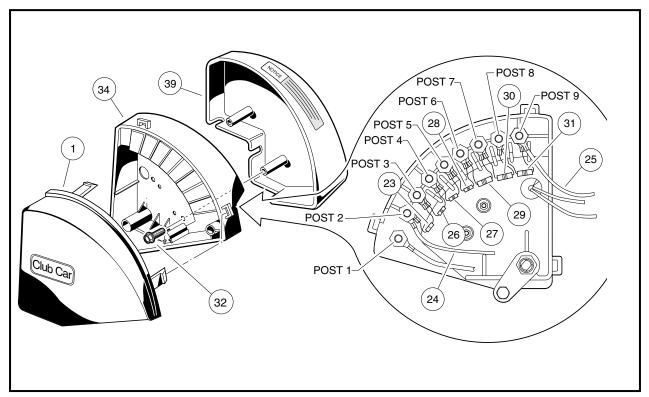


Figure 12-18 Resistors

- 8. Install the 1000 Ω (ohm) resistor assembly (31) (color bands brown, black, red, and gold) onto the eighth and ninth threaded posts (Figure 12-18, Page 12-24).
- 9. Make sure the purple wire (24) is connected to the second threaded post and the white/black wire (25) is connected to the ninth threaded post (Figure 12-18, Page 12-24).

A WARNING

- MAKE SURE WIRES ARE CONNECTED TO WIPER SWITCH CONTACTS EXACTLY AS STATED. IF THEY ARE NOT, THE VEHICLE COULD START IN A SPEED OTHER THAN FIRST.
- 10. Install eight 1/4-20 hex nuts onto the threaded posts (with resistors attached) and tighten to 40 in-lb (4.5 N-m) (Figure 12-18, Page 12-24).
- 11. Coat all terminals with Battery Protector Spray (Club Car Part Number 1014305) to minimize corrosion.
- 12. Install both of the plastic wiper switch covers (1 and 39) (Figure 12-18, Page 12-24).

BATTERY WARNING LIGHT

Read DANGER and WARNING on page 12-1.

Testing the Battery Warning Light

See Section 11, Test Procedure 17, Page 11-26.

Battery Warning Light Removal

- 1. Disconnect the battery wires, negative cable first (Figure 12-1, Page 12-2) and discharge the controller.
- 2. Remove center dash. See Remove Center Dash on Page 12-2.
- 3. Disconnect the brown wire at the spade terminal and remove the orange/white wire from the key switch. Do not allow wires to touch.
- 4. Depress the two retaining tabs (11) and remove the light from the center dash (Figure 12-19, Page 12-25).

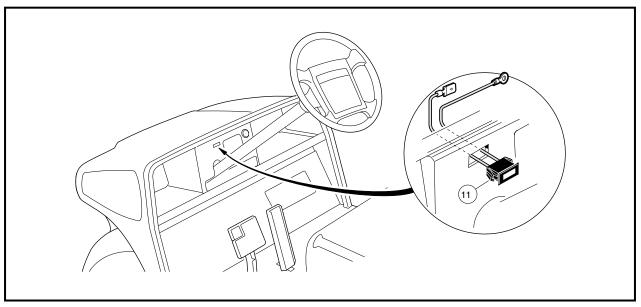


Figure 12-19 Battery Warning Light

Battery Warning Light Installation

1. Install in reverse order of removal. Reconnect the battery cables, positive cable first, and tighten terminals to 110 in-lb (12.4 N-m). Coat terminals with Battery Protector Spray (Club Car Part No. 1014305) to minimize corrosion.

SECTION 13-BATTERIES

A DANGER

- BATTERY EXPLOSIVE GASES! DO NOT SMOKE, KEEP SPARKS AND FLAMES AWAY. VENTILATE WHEN CHARGING OR USING IN AN ENCLOSED SPACE. ALWAYS WEAR FULL FACE SHIELD AND RUBBER GLOVES WHEN WORKING ON OR NEAR BATTERIES.
- USE EXTREME CAUTION WHEN USING TOOLS. WIRES. OR METAL OBJECTS NEAR BATTERIES! A SHORT CIRCUIT AND (OR) SPARK COULD CAUSE AN EXPLOSION.
- BATTERY POISON! CONTAINS ACID! CAUSES SEVERE BURNS. AVOID CONTACT WITH SKIN, EYES, OR CLOTHING. ANTIDOTES:
 - EXTERNAL: FLUSH WITH WATER. CALL A PHYSICIAN IMMEDIATELY.
 - INTERNAL: DRINK LARGE QUANTITIES OF MILK OR WATER. FOLLOW WITH MILK OF MAGNESIA OR VEGETABLE OIL. CALL A PHYSICIAN IMMEDIATELY.
 - EYES: FLUSH WITH WATER FOR FIFTEEN MINUTES. CALL PHYSICIAN IMMEDIATELY.

A WARNING

- ONLY TRAINED TECHNICIANS SHOULD REPAIR OR SERVICE THIS VEHICLE. ANYONE DOING EVEN SIMPLE REPAIRS OR SERVICE SHOULD HAVE KNOWLEDGE AND EXPERIENCE IN ELECTRICAL AND MECHANICAL REPAIR.
- FOLLOW ALL PROCEDURES EXACTLY AS STATED IN THIS MANUAL, AND HEED ALL DANGER. WARNING AND CAUTION STATEMENTS, AS WELL AS THOSE AFFIXED TO THE VEHICLE.
- WEAR SAFETY GLASSES OR APPROVED EYE PROTECTION WHILE SERVICING VEHICLE.
- TURN KEY SWITCH OFF, PLACE FORWARD/REVERSE HANDLE IN NEUTRAL, AND REMOVE KEY PRIOR TO SERVICING.
- DO NOT WEAR LOOSE CLOTHING, REMOVE JEWELRY SUCH AS RINGS, WATCHES, CHAINS. ETC. BEFORE SERVICING VEHICLE.
- USE INSULATED TOOLS WHEN WORKING NEAR BATTERIES OR ELECTRICAL CONNECTIONS. USE EXTREME CAUTION TO AVOID SHORTING OF COMPONENTS OR WIRING.
- TO AVOID UNINTENTIONALLY STARTING THE VEHICLE, DISCONNECT BATTERIES AS SHOWN IN FIGURE 13-5, PAGE 13-4. DISCHARGE THE CONTROLLER AS FOLLOWS:
 - TURN KEY SWITCH TO ON AND PLACE THE FORWARD/REVERSE HANDLE IN THE **REVERSE POSITION.**
 - SLOWLY DEPRESS THE ACCELERATOR PEDAL AND KEEP IT DEPRESSED UNTIL THE REVERSE WARNING BUZZER CAN NO LONGER BE HEARD. WHEN THE BUZZER STOPS SOUNDING, THE CONTROLLER IS DISCHARGED.

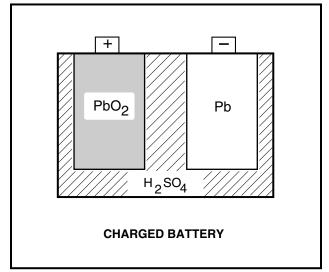
GENERAL INFORMATION

The batteries supplied with a PowerDrive System 48 vehicle are different from those supplied with an automobile. The outward appearance of these two batteries is similar, but the operating characteristics are very different. The PowerDrive System 48 vehicle battery is a deep-cycle battery, and the automotive battery is a "starting, lighting and ignition" (SLI) battery. They should never be substituted for one another.

An automotive battery has to deliver high-cranking currents of 300-400 amperes at a sufficient voltage for several seconds and maintain an accessory load of 10-25 amperes in stop-and-go driving. The energy removed from an automotive battery is immediately replaced by the alternator or generator. As a result, the automotive battery operates at 90 to 100% of full charge at all times.

13 BATTERIES General Information

General Information, Continued:



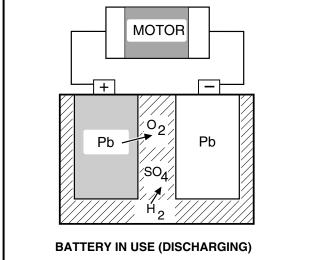
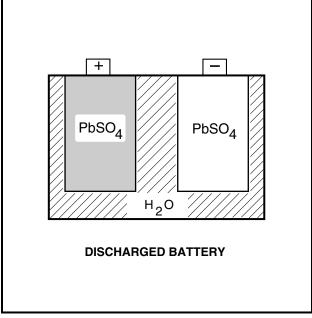


Figure 13-1 Charged Battery

Figure 13-2 Discharging Battery



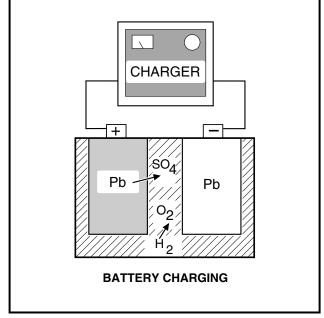


Figure 13-3 Discharged Battery

Figure 13-4 Charging Battery

The batteries supplied with an electric vehicle must supply 100% of the energy required to operate the vehicle. These batteries therefore, receive a deep discharge down to 30% to 40% of their full charge capacity. Then they must be recharged, hence the name "deep cycle." The average amperage draw is considered to be 56 amps on a 48 volt vehicle, although it varies greatly depending on the vehicle and how it is operated. PowerDrive System 48 vehicle batteries are specifically designed to handle this type of service.

The rechargeable lead-acid battery turns chemical energy into electrical energy and vice versa. The main active elements within a battery are the positive plates, the negative plates and the electrolyte (sulfuric acid). Another very important element (but, inactive) is the separator. The separator does exactly what its name implies - it separates the material of the positive and negative plates and prevents them from touching each other, which would create electrical short circuits. The separator is porous enough to allow charged ions to pass between the positive and negative plates, but not allow the two materials to contact each other.

Whenever two unlike metals are immersed in an acid solution, an electric current is generated. In a deepcycle battery, the negative plates contain lead (Pb) and the positive plates contain lead dioxide (PbO₂). These plates are immersed in a sulfuric acid solution (H₂SO₄) (Figure 13-1, Page 13-2).

During discharge, the chemical reaction inside the battery causes the sulfate (SO₄) to break away from the H₂ (Figure 13-2, Page 13-2).

The sulfate (SO_4) combines with the lead (Pb) on both plates, forming lead sulfate ($PbSO_4$). Oxygen (O_2) from the positive plates combines with hydrogen (H) from the electrolyte to form water (H2O) (Figure 13-3, Page 13-2).

The result is two similar metals, lead sulfate (PbSO₄) immersed in water (H₂O). This, will not generate electricity because the battery is completely discharged.

When a discharged battery is connected to a charger, the process is reversed. The sulfate (SO₄) is forced from the plates back into the electrolyte to make sulfuric acid (H₂SO₄). The oxygen returns to the positive plate to make lead dioxide (PbO₂) (Figure 13-4, Page 13-2).

The result is a charged battery that is again capable of generating electricity (Figure 13-1, Page 13-2).

COMMON MISCONCEPTIONS ABOUT BATTERIES

The chart below describes some of the more common misconceptions that are associated with the Power-Drive System 48 vehicle batteries and battery care.

	PROBLEM	MISCONCEPTION AND REALITY
1.	Deep-Discharge	Misconception- "This vehicle is running slowly, but we can run it until it stops." Reality- This statement is wrong. Avoid deep discharge of batteries whenever possible. See Deep-Discharge, Page 13-7.
2.	Early Excessive Discharging	Misconception- "These are new batteries. They can run all day." Reality- This statement is wrong also. New batteries do not reach their full capacity until they have been used and recharged 20 to 50 times. See Early Excessive Discharging, Page 13-7.
3.	Mineral Content	Misconception- "Tap water will do for our batteries." Reality- Your tap water might be OK, but have it checked first. See Mineral Content, Page 13-6.
4.	Self-Discharge	Misconception- "Dirt and corrosion on the battery won't hurt anything." Reality- Wrong again. Dirt and corrosion might provide a path for current to flow and allow the batteries to self-discharge. See Self-Discharge, Page 13-5.
5.	Overwatering	Misconception- "Batteries can be filled to the level indicator at night, so it won't have to be done in the morning". Reality- Under most circumstances, water should be added after charging. See Electrolyte Level, Page 13-5.
6.	Underwatering	Misconception- "Checking the water takes too much time; it can be checked once a month." Reality- Insufficient watering can ruin batteries. Water level should be checked weekly. See Electrolyte Level, Page 13-5.
7.	Vibration Damage	Misconception- "You should tighten battery hold-downs as tight as you can". Reality- Battery hold-downs should be tightened to specification. Hold-downs that are too tight or too loose can cause battery damage. See Vibration Damage, Page 13-6.

BATTERIES Replacing Batteries

REPLACING BATTERIES

A WARNING

• TO PREVENT ELECTROLYTE LEAKAGE FROM THE BATTERY VENTS, BATTERIES MUST BE KEPT IN AN UPRIGHT POSITION. TIPPING A BATTERY BEYOND A 45° ANGLE IN ANY DIRECTION CAN ALLOW A SMALL AMOUNT OF ELECTROLYTE TO LEAK OUT THE VENT HOLE. DO NOT EXCEED THIS 45° ANGLE WHEN LIFTING, CARRYING, OR INSTALLING BATTERIES. BATTERY ACID CAN CAUSE SEVERE PERSONAL INJURY TO SKIN OR EYES, AND CAN DAMAGE CLOTHING.

- Before removing batteries, note the orientation of the batteries and the connecting wires. Disconnect
 the batteries and discharge the controller as described in the WARNING on page 13-1. Then remove
 remaining wires and batteries. See Figure 13-5, Page 13-4 for PowerDrive System 48 vehicle battery wiring.
- 2. Visually inspect the new batteries for any damage that may have occurred in transit.
- 3. If old battery cables are to be reused, inspect them for broken or frayed wires, damaged terminals, or worn insulation. Remove any corrosion on the connectors. One cup of bicarbonate of soda (baking soda) in a gallon of water and a bristle brush do an excellent job of neutralizing and removing the corrosion. Be careful not to allow the baking soda solution to enter the battery.

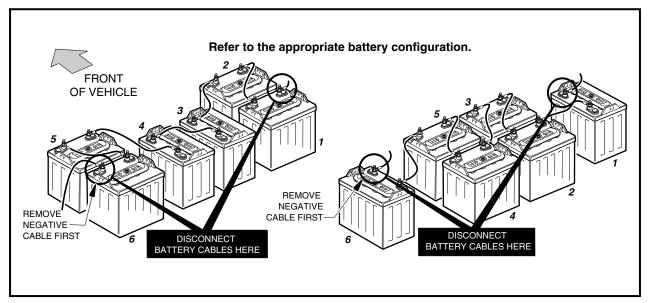


Figure 13-5 PowerDrive Battery Configuration

- 4. Check and clean the battery rack and hold-downs. The nuts and bolts on the hold-downs may corrode. It is therefore advised they be cleaned periodically and replaced as necessary.
- 5. Install batteries in the proper orientation (Figure 13-5, Page 13-4). Install battery hold-downs. The hold-downs should be tight enough so batteries do not move while vehicle is in motion, but not so tight as to crack or buckle battery case. Tighten to 40 in-lb (4.5 N-m), alternating between hold-down bolts.
- 6. Install wires in proper sequence (Figure 13-5, Page 13-4). Install black wire to negative post of battery No. 6 last. Make sure all connections are tight. Tighten to 110 in-lb (12.4 N-m). Coat all terminals with Battery Protector Spray (Club Car Part No.1014305) to minimize future corrosion.
- 7. Give the batteries a full charge prior to operation. This ensures all the batteries are fully charged and the cells are equalized prior to use.

Battery Care

BATTERY CARE

Read DANGER and WARNING on page 13-1.

PREVENTIVE MAINTENANCE

To keep batteries in sound operating condition, follow these steps on a regular basis.

- Any corrosion build-up on or around batteries should be removed immediately. Terminal connections should be clean and tight. Any frayed or worn wires should be replaced. After all cables have been connected, coat all terminals with Battery Protector Spray (Club Car Part No.1014305) to help prevent future corrosion.
- 2. Batteries should be kept clean and dry to prevent self-discharge. Any dirt, grime or acid spillage should be removed. Wash batteries with a bristle brush using water and bicarbonate of soda (baking soda - 1 cup per gallon of water). Rinse with water. Do not allow solution to enter battery through the vent cap holes. See Self-Discharge below.
- 3. Maintain proper electrolyte level. See Electrolyte Level below.
- 4. Batteries should be properly charged every day they are used. Check the batteries periodically to see that they are in a full state of charge. See Battery Charging, Page 13-6.
- 5. Keep hold-downs tight. See Vibration Damage, Page 13-6.

SELF-DISCHARGE

Dirty batteries can provide a path for a small current draw that can slowly discharge batteries, thus wasting valuable energy. To prevent self-discharge, batteries should always be kept clean.

Hot weather also has an effect on a battery's self-discharge rate. The higher the temperature, the quicker a set of batteries will discharge. In hotter climates, batteries should be checked more often. When storing batteries, keep in a cool place. See Battery Storage, Page 13-13.

ELECTROLYTE LEVEL

A CAUTION

 DO NOT ALLOW BATTERY ACID FROM BATTERY CAPS OR HYDROMETER TO DRIP ONTO THE FRONT OR REAR BODY OF THE VEHICLE. BATTERY ACID WILL CAUSE PERMANENT DAMAGE. WASH IMMEDIATELY.

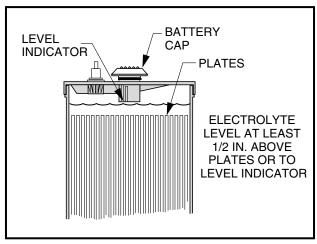


Figure 13-6 Battery Electrolyte Level

BATTERIES Battery Charging

Electrolyte Level, Continued:

Add water only after charging unless the electrolyte is below the level of the plates. If the electrolyte level is below the level of the plates, add just enough water to cover the plates and then charge the batteries. After charging, fill with water to the level indicator. Filling a battery to the level indicator before charging will result in overfilling because the electrolyte level will rise during charging and some of the electrolyte may bubble out of the cap. This reduces the battery's capacity and corrodes the metal parts around it.

The electrolyte level should be checked weekly to be sure electrolyte is at its proper level (Figure 13-6, Page 13-5). Never allow the electrolyte level to fall below the tops of the plates because this will cause the exposed part of the plate to become permanently inactive. For best results, use a battery watering gun to add water to batteries. Check the electrolyte level more frequently in hot weather or when batteries are old.

MINERAL CONTENT

For the longest battery life, use distilled water in batteries. However, if tap water is to be used, be sure the mineral contents are below these levels:

IMPURITY	ALLOWABLE CONTENT IN PARTS PER MILLION
Suspended Matter	Trace
Total Solids	100.00
Calcium and Magnesium Oxides	40.0
Iron	5.0
Ammonia	8.0
Organic Matter	50.0
Nitrates	10.0
Nitrites	5.0
Chloride	5.0
Contact your local water department for this analys	sis.

VIBRATION DAMAGE

The battery hold-downs should always be tight enough to keep the battery from bouncing. Battery life may be severely shortened if the battery hold-downs are too loose. Battery hold-downs should be tightened to 40 in-lb (4.5 N-m). Excessive vibration causes the plates to shed prematurely and shortens the life of the battery. It may also cause acid to leak out of the vent caps and corrosion to build up on surrounding metal parts. The acid which is lost reduces the capacity of the battery and cannot be replaced. Battery hold-downs should NOT be so tight as to crack or buckle the battery case. This may cause leaks which would dry out a cell or cause internal short circuits. **See Replacing Batteries, Page 13-4**.

BATTERY CHARGING

Read DANGER and WARNING on page 13-1.

The charger supplied with the PowerDrive System 48 electric vehicle resolves the most common problems associated with battery charging. Undercharging and overcharging are prevented provided the charger is allowed to shut off by itself. Also, all cells are automatically given an equalization charge at low current, which prolongs battery life. Batteries should never be left in a discharged state, as this too affects the internal components and can reduce the capacity of the battery. The batteries should be charged every day they are used. However, the batteries should not be charged if they have not been used.

CHARGER SHUTS OFF AFTER 16 HOURS

This may be due to,1) new batteries, 2) hard use or 3) cold temperatures. A catch-up charge may be necessary when these conditions are present. On those days when all or some of the vehicles do not get used, check the batteries for state of charge. Any battery with a specific gravity lower than 1.250 will need a catchup charge. If the problem continues after a catch-up charge has been performed, refer to Section 14-PowerDrive Battery Charger.

DEEP-DISCHARGE

Never discharge batteries to the point the vehicle will no longer operate. This will considerably shorten the cycle life of the batteries, and may permanently damage the batteries. It is possible the batteries will not accept a recharge if they are completely discharged. The deeper the discharge, the harder it is on the batteries. For this reason, it is recommended that PowerDrive System 48 vehicle batteries be charged after each use (provided the charge cycle will not be interrupted and the charger will be allowed to shut off automatically). Placing the batteries on charge after each use reduces the depth of discharge and prolongs battery life.

EARLY EXCESSIVE DISCHARGING

When vehicle batteries are new, they do not reach their full capacity until they have been used and recharged 20 to 50 times. If they are excessively discharged early in their life, their effective service life will be shortened. It is advisable to limit the use of any vehicle with new batteries for at least the first four weeks and then gradually increase their range.

INCOMING AC SERVICE

Make sure the incoming AC line service is sufficient. If circuit breakers are tripping, fuses blow during the night or the charger does not give the required starting rate when sound batteries are put on charge, an AC line problem exists. The electrical service to the vehicle storage facility should be sufficient to deliver adequate voltage and current to each charger with all the chargers turned on. If not, consult your local power company or electrical contractor. See Section 14-PowerDrive Battery Charger.

FLEET ROTATION

Rotate vehicle usage. It is very hard on batteries if the last vehicles in at night are the first ones out in the morning. Spread the workload evenly, giving all vehicles the same amount of use. This will keep your fleet in balance and will not overwork certain sets of batteries.

NOTE

 WHEN VEHICLES ARE BEING ROTATED, THE CLUB CAR CDM (COMMUNICATION DISPLAY MODULE) CAN BE A VERY HELPFUL SERVICE TOOL. MONITORING THE VALUE OF FUNCTION 3 WITH THE CDM SIMPLIFIES VEHICLE USAGE SCHEDULING. SEE SECTION 11, **PAGE 11-27**.

NUMBERING VEHICLES AND CHARGERS

Return the vehicles to the same charger each night if possible. If the vehicles are put in a storage facility at random and a vehicle dies while in use and testing shows the batteries are sound, then the problem is most likely with the charger. However, finding the problem charger may prove to be quite time consuming. Numbering the vehicles and the chargers and returning each vehicle to its designated charger each night can significantly reduce the amount of time spent troubleshooting a problem.

BATTERIES Battery Testing

BATTERY TESTING

Read DANGER and WARNING on page 13-1.

Four tests have been developed to help diagnose problems with batteries that have not performed as expected. Because each test becomes progressively more detailed and time-consuming, begin with the first test and follow through with the other tests until the problem has been identified as outlined in the Battery Troubleshooting Chart (Figure 13-7, Page 13-9).

BATTERY CHARGER TEST

The easiest way to monitor the condition of a vehicle's batteries is simply to observe the reading on the battery charger ammeter at the end of the charge cycle. After a full charge, disconnect the charger DC plug, wait 20 to 30 seconds and reconnect the charger DC plug. The ammeter needle will jump to 15 amps or more and then taper to below 6 amps within 10 to 20 minutes, indicating sound, fully charged batteries.

Continued poor performance may indicate a problem in the vehicle electrical system, brakes or battery charger. If the problem is not found in the vehicle or charging system, proceed to the on-charge voltage test. Batteries that remain at 8 amps or higher should be tested further using the on-charge voltage test.

ON-CHARGE VOLTAGE TEST

When the batteries are fully charged, disconnect the charger DC plug. Wait 20 to 30 seconds and reconnect the DC plug to restart the charger. After 5 minutes, use a multimeter to check and record the voltage of the battery set as well as the individual batteries. Set the meter to 200 volts DC. Place the red (+) probe at the positive post of battery No. 1 and the black (–) probe at the negative post of battery No. 6 (Figure 13-5, Page 13-4). Record reading. Then set multimeter to 20 volts DC and place the red (+) probe at the positive terminal and the black (–) probe at the negative terminal of each battery. Record the readings.

The on-charge voltage for the set should be between 56.0 volts and 63.0 volts depending on the age and state of charge of the batteries being tested. If individual batteries read above 9.3 volts and are within 0.7 volts of each other, go to hydrometer test. If any battery reads below 9.3 volts and not within 0.7 volts of those batteries above 9.3 volts, replace battery. If readings are below 9.3 volts but within 0.7 volts of each other, the batteries are old. Old batteries may have enough capacity left to last several more months. Go to hydrometer test. **See Troubleshoot-**

ing Chart, Figure 13-7, Page 13-9, and examples on following pages

HYDROMETER TEST

A hydrometer measures the specific gravity of the battery's electrolyte. The higher the specific gravity, the higher the state of charge of the batteries. A fully charged battery should read between 1.250 and 1.280 at 80°F (26.7°C). Never add acid to batteries to obtain a higher specific gravity.

Performing the Hydrometer Test

- 1. Be sure batteries have sufficient electrolyte to cover plates by approximately 1/2 inch and are fully charged prior to beginning test. If water must be added, recharge the batteries before performing the hydrometer test.
- 2. Remove the vent cap. Using a battery thermometer (Club Car part No.1011767), record electrolyte temperature of the No. 2 cell.
- 3. Squeeze the rubber bulb of the hydrometer and insert into the cell. Slowly release the bulb, drawing electrolyte up into the glass tube of the hydrometer.
- 4. When the float rises off the bottom, adjust the electrolyte level so that the float rides free of the bottom but does not strike the top of the glass tube. Remove the hydrometer from the cell and release the pressure from the bulb.
- 5. Hold the hydrometer vertically, ensuring the float is not touching the sides of the barrel. Hold the hydrometer at eye level and read the scale at the level of electrolyte (Figure 13-8, Page 13-10).
- 6. Record the reading and return the electrolyte to the cell from which it was taken. Replace vent cap. Repeat steps 2 through 6 on all cells. .

Battery Testing 13

BATTERY TROUBLESHOOTING CHART

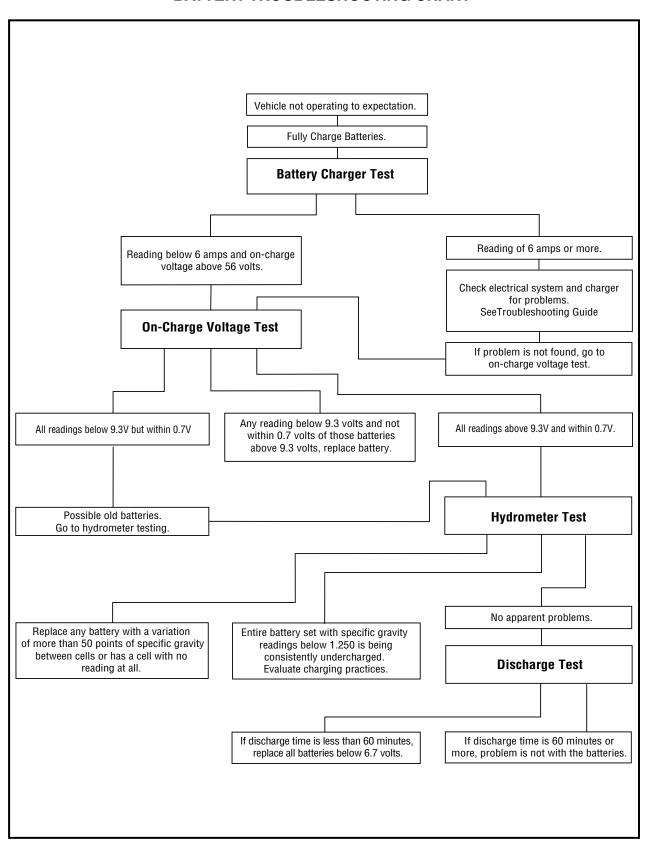


Figure 13-7 Troubleshooting Chart

Battery Testing

Hydrometer Calibration

Most hydrometers are calibrated to read correctly at $80^{\circ}F$ (26.7°C). The readings obtained as described above must be corrected for temperature. For each $10^{\circ}F$ (5.6°C) above $80^{\circ}F$ (26.7°C), add .004 to the reading. For each $10^{\circ}F$ (5.6°C) below $80^{\circ}F$ (26.7°C), subtract .004 from the reading.

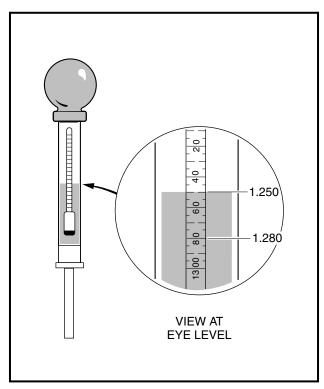


Figure 13-8 Hydrometer

Interpreting the Results of the Hydrometer Test

The approximate state of charge can be determined from the following table:

SPECIFIC GRAVITY AT 80°F (26.7°C)	STATE OF CHARGE
1.250 - 1.280	100%
1.220 - 1.240	75%
1.190 - 1.210	50%
1.160 - 1.180	25%

If the difference between the cells is .020 or more, the low cell should be suspected. It may require a catchup charge or it may be a weak cell. When the variations between cells reach .050 or more, the battery with the low cell should be replaced.

VEHICLE	BATTERY	ELECTROLYTE	CORRECTION		REQUIRED			
NO.	NO.	TEMP.	FACTOR	CELL 1	CELL 2	CELL 3	CELL 4	ACTION
12	1	20°F (-6.6°C)	024	1.275024=1.251	1.280024=1.256	1.280024=1.256	1.280024=1.256	Sound Battery- Fully Charged
35	6	90°F (32.2°C)	+.004	1.155+.004=1.159	1.165+.004=1.169	1.160+.004=1.164	1.165=.004=1.169	Discharged Battery- Recharge
54	3	50°F (10°C)	012	1.260012=1.248	1.200012=1.188	1.270012=1.258	1.270012=1.258	Bad No. 2 Cell

VEHICLE	BATTERY	ELECTROLYTE	CORRECTION		REQUIRED			
NO.			FACTOR	CELL 1	CELL 2	CELL 3	CELL 4	ACTION
69	5	80°F (26.7°C)	.000	1.250-0=1.250	1.255-0=1.255	1.230-0=1.230	1.250-0=1.250	Weak No. 3 Cell- Catch-up Charge
38	2	100°F (37.8°C)	+.008	1.200+.008=1.208	1.180+.008=1.188	1.170+.008=1.178	1.180+.008=1.188	Discharged Battery- Recharge and Recheck
22	4	80°F (26.7°C)	.000	1.240-0=1.240	1.245-0=1.245	Float Does Not Rise	1.250-0=1.250	No.3 Cell Dead- Replace Battery

DISCHARGE TEST

If the previous tests have failed to identify the problem, conduct a discharge test. The discharge test comes closest to simulating actual vehicle operating conditions by continuously drawing 56 amps from the batteries until voltage drops to 42.0 volts.

The discharge test is the hardest test on the batteries and the most time-consuming to perform. Use the battery discharge tester (Club Car Part No.101831901).

Performing the Discharge Test

- 1. Be sure the batteries are fully charged and that the electrolyte level is correct in all cells.
- 2. Connect the tester leads to the positive (+) post of battery No.1 and negative (-) post of battery No.6 (Figure 13-9, Page 13-11).

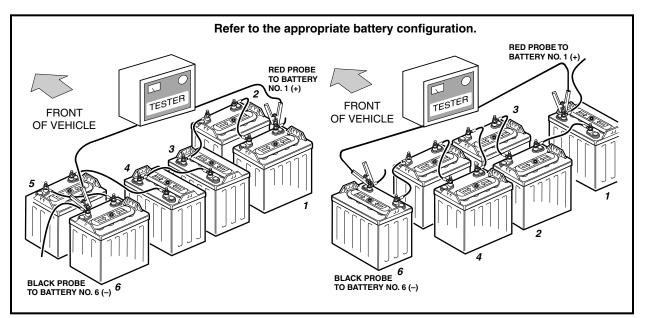


Figure 13-9 Battery Discharge Test

- 3. Check and record the electrolyte temperature of the battery packs. Check cell No. 2 (second cell from positive post) in each battery.
- 4. Reset discharge machine and turn the tester ON.
- 5. When the batteries have been discharging for approximately 60 minutes, set the discharge machine to function 3 and check battery set voltage. Check voltage every 10 minutes throughout the rest of the test. As soon as the battery set voltage reaches .5 volts above the shut-off point (42.0 volts), use a multimeter to measure individual battery voltages. Measure and record the voltage of each battery to the nearest .01 volt.

NOTE

• THE TESTER WILL SHUT OFF AUTOMATICALLY WHEN SHUT-OFF VOLTAGE IS REACHED.

Page 13-11

Battery Testing

Interpreting Discharge Test Results

- 1. If discharge time is 60 minutes or higher, the problem is not with the batteries.
- 2. If discharge times are low (less than 60 minutes), replace batteries below 6.7 volts.

BATTERY VOLTAGES						
1	2	3	4	5	6	BATTERY CONDITION
7.00	7.00	7.00	7.00	7.00	7.00	EXCELLENT
7.07	7.07	7.22	6.50	7.07	7.07	BATTERY NO. 4 IS NEAR END OF USEFUL LIFE
7.20	7.20	6.67	7.33	6.27	7.33	BATTERY NOS. 3 AND 5 ARE NEAR END OF USEFUL LIFE

3. In general, vehicles that discharge in less than 60 minutes at 78°F (25.6°C) on the discharge test will typically not hold a charge for an entire work shift. However, discharge time is dependent on the electrolyte temperature. The table shown gives the discharge times, at various temperatures, of a set of batteries that delivers 62 minutes at 80°F (26.7°C).

ELECTROLYTE TEMP. °F (°C)	DISCHARGE TIME TO SHUT-OFF POINT	ELECTROLYTE TEMP. °F (°C)	DISCHARGE TIME TO SHUT-OFF POINT
40 - 49 (4.4 - 9.4)	40 Minutes	85 - 89 (29.4 - 31.7)	64 Minutes
50 - 59 (10 - 15)	45 Minutes	89 - 99 (31.7 - 37.2)	66 Minutes
60 - 64 (15.6 - 17.8)	50 Minutes	100 - 109 (37.8 - 42.8)	68 Minutes
65 - 69 (18.3 - 20.6)	54 Minutes	110 - 119 (43.3 - 48.3)	70 Minutes
70 - 74 (21.1 - 23.3)	57 Minutes	120 - 129 (48.9 - 53.9)	72 Minutes
75 - 79 (23.9 - 26.1)	60 Minutes	130 - 150 (54.4 - 65.6)	74 Minutes
80 - 84 (26.7 - 28.9)	62 Minutes	****	****

BATTERY TROUBLESHOOTING EXAMPLES

The following information represents a few examples of troubleshooting battery problems.

Example 1

Vehicle No. 68 was suspected of having a bad battery due to its performance. As a result, the battery charger test was performed. After a full charge, the battery charger ammeter read 8.0 amps. Next, the on-charge voltage test was performed and the following results were recorded:

BATTERY NO.	1	2	3	4	5	6
ON-CHARGE VOLTAGE	10.15	10.60	9.80*	10.16	10.56	10.61

^{*}Battery No. 3 appears suspect. Battery Nos. 1 and 4 are also suspect. Next, a hydrometer test should be conducted on all batteries.

Hydrometer test results:

BATTERY NO.	1	2	3	4	5	6
	SPECIFIC GRAVITY					
CELL 1 (POSITIVE POST)	1.200*	1.265	1.300	1.250	1.280	1.260
CELL 2	1.285	1.275	1.290	1.270	1.295	1.265
CELL 3	1.265	1.270	1.275	1.265	1.280	1.275
CELL 4 (NEGATIVE POST)	1.275	1.270	1.285	1.265	1.275	1.275

^{*}After the hydrometer test, it appears that battery No. 1 is the problem. Next, the discharge test was performed.

Discharge test results:

BATTERY NO.	1	2	3	4	5	6
DISCHARGE VOLTAGE	5.44*	7.33	7.73	7.15	7.43	7.41

^{*}After a discharge test which lasted 45 minutes, battery No. 1 is clearly shown to be the problem. Battery No. 4 should be watched a little more closely but appears to be okay. Battery No. 1 should be replaced with a battery that has about the same age and usage as the other batteries in the set.

Example 2

Vehicle No. 70 was also suspected of having a bad battery due to its performance. The battery charger test showed 7.0 amps after a full charge. After confirming there were no problems with the electrical system, charger or brakes, the on-charge voltage was recorded as follows:

BATTERY NO.	1	2	3	4	5	6
ON-CHARGE VOLTAGE	10.48	9.77*	10.53	10.57	10.55	10.33

^{*}Battery No. 2 was immediately suspected as the problem. After checking battery No. 2 with a hydrometer, it was discovered that the negative post cell was completely dead. Battery No. 2 should be replaced with a battery that has the same age and usage as the other batteries in the set.

BATTERY STORAGE

Read DANGER and WARNING on page 13-1.

When storing batteries during the off-season or when maintaining a replacement stock, follow these guidelines:

- 1. Keep the batteries clean and free of corrosion as outlined in Battery Care, page 13-5.
- 2. Batteries that are in vehicles for winter storage should be left disconnected in the vehicles if the batteries are not going to be connected to a charger.
- 3. Fully charge the batteries prior to storage.
- 4. Store in a cool area. The colder the area in which the batteries are stored, the less the batteries will self-discharge. Batteries stored at 0°F (-17.8°C) will discharge very little over a four-month period. Batteries stored at 80°F (26.7°C) will have to be recharged every few weeks.
- 5. Vehicles with PowerDrive System 48 and PowerDrive Chargers are designed to be left connected, with AC power to the charger ON, during off-season storage. The PowerDrive storage charge feature will automatically charge the batteries as needed throughout the storage period.

CHARGING A BATTERY PACK THAT HAS LOW VOLTAGE

See Section 14-PowerDrive Battery Charger.

SECTION 14-POWERDRIVE BATTERY CHARGER

A DANGER

- BATTERY EXPLOSIVE GASES! DO NOT SMOKE, KEEP SPARKS AND FLAMES AWAY. VENTILATE WHEN CHARGING OR USING IN AN ENCLOSED SPACE. ALWAYS WEAR FULL FACE SHIELD AND RUBBER GLOVES WHEN WORKING ON OR NEAR BATTERIES.
- USE EXTREME CAUTION WHEN USING TOOLS, WIRES, OR METAL OBJECTS NEAR BATTERIES! A SHORT CIRCUIT AND (OR) SPARK COULD CAUSE AN EXPLOSION.
- BATTERY POISON! CONTAINS ACID! CAUSES SEVERE BURNS. AVOID CONTACT WITH SKIN, EYES, OR CLOTHING. ANTIDOTES:
 - EXTERNAL: FLUSH WITH WATER. CALL A PHYSICIAN IMMEDIATELY.
 - INTERNAL: DRINK LARGE QUANTITIES OF MILK OR WATER. FOLLOW WITH MILK OF MAGNESIA OR VEGETABLE OIL. CALL A PHYSICIAN IMMEDIATELY.
 - EYES: FLUSH WITH WATER FOR FIFTEEN MINUTES. CALL PHYSICIAN IMMEDIATELY.

A WARNING

- ONLY TRAINED TECHNICIANS SHOULD REPAIR OR SERVICE THIS VEHICLE. ANYONE DOING EVEN SIMPLE REPAIRS OR SERVICE SHOULD HAVE KNOWLEDGE AND EXPERIENCE IN ELECTRICAL AND MECHANICAL REPAIR.
- FOLLOW ALL PROCEDURES EXACTLY AS STATED IN THIS MANUAL, AND HEED ALL DANGER, WARNING AND CAUTION STATEMENTS, AS WELL AS THOSE AFFIXED TO THE VEHICLE.
- WEAR SAFETY GLASSES OR APPROVED EYE PROTECTION WHILE SERVICING VEHICLE.
- TURN KEY SWITCH OFF, PLACE FORWARD/REVERSE HANDLE IN NEUTRAL, AND REMOVE KEY PRIOR TO SERVICING.
- DO NOT WEAR LOOSE CLOTHING. REMOVE JEWELRY SUCH AS RINGS, WATCHES, CHAINS, ETC. BEFORE SERVICING VEHICLE.
- USE INSULATED TOOLS WHEN WORKING NEAR BATTERIES OR ELECTRICAL CONNECTIONS. USE EXTREME CAUTION TO AVOID SHORTING OF COMPONENTS OR WIRING.
- DISCONNECT THE ELECTRICAL CORDS BEFORE ATTEMPTING ANY REPAIR TO THE CHARGER. FIRST DISCONNECT THE AC CORD FROM THE OUTLET AND THEN DISCONNECT THE DC CORD FROM THE VEHICLE.
- TO AVOID UNINTENTIONALLY STARTING THE VEHICLE, DISCONNECT BATTERIES AS SHOWN IN FIGURES 14-2 AND 14-3, PAGE 14-4. DISCHARGE CONTROLLER AS FOLLOWS:
 - TURN KEY SWITCH TO ON AND PLACE THE FORWARD/REVERSE HANDLE IN THE **REVERSE POSITION.**
 - SLOWLY DEPRESS THE ACCELERATOR PEDAL AND KEEP IT DEPRESSED UNTIL THE REVERSE WARNING BUZZER CAN NO LONGER BE HEARD. WHEN THE BUZZER STOPS SOUNDING, THE CONTROLLER IS DISCHARGED.

GENERAL INFORMATION

The PowerDrive Battery Charger is an integral part of the PowerDrive System 48 vehicle, and one is included with every PowerDrive vehicle. Because it is controlled by the PowerDrive System 48 onboard computer (OBC), it can be used with PowerDrive Plus and PowerDrive System 48 vehicles only. The charger is totally automatic and has no external controls; when it is plugged into the vehicle receptacle, there is a 2 to 15 second delay

General Information, Continued:

before charging begins (Figure 14-1, Page 14-2). The OBC records the amount of energy consumed as the vehicle is used then directs the charger to replace exactly the amount of energy needed to fully replenish the batteries. See following NOTE.

NOTE

 SHORTLY AFTER CHARGING BEGINS, THE CHARGER WILL SHUT OFF IN ORDER TO RUN A SELF-DIAGNOSTIC PROGRAM (AMMETER WILL DROP TO ZERO). CHARGING WILL RESUME IN A FEW MOMENTS (AMMETER RETURNS TO PREVIOUS RATE OF CHARGE). THIS WILL BE REPEATED AT ONE HOUR AND AT TWO HOURS INTO THE CHARGE CYCLE.

The charger then shuts off automatically, preventing the possibility of either undercharging or overcharging. The computer accomplishes this by detecting when the exact amount of energy required has been returned to the batteries.

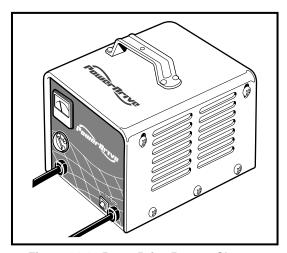


Figure 14-1 PowerDrive Battery Charger

POWERDRIVE CHARGING FEATURES

- Charge Interlock: PowerDrive Battery Charger DC plugs have three pins rather than two blades that most standard charger plugs have. Two of these pins are the positive and negative leads as on standard chargers; the third pin is a sensing lead which is the communication link between the charger and the onboard computer. When the charger plug is inserted into the vehicle receptacle, the onboard computer locks out the vehicle's drive system. This prevents the possibility of driving the vehicle while the charger is plugged in and potentially damaging the vehicle and charger.
- Long-Term Storage Charge: PowerDrive System 48 vehicles and PowerDrive Chargers are designed
 to be left connected, with AC power to the charger. The onboard computer will automatically activate
 the charger every 15 days. To return the vehicle to service, disconnect the DC cord from the vehicle,
 wait 15 seconds and then plug the DC cord back in. The charger will activate. Allow the vehicle to complete one full charge cycle before putting it into service.
- Charger Disconnect: The computer communication pin is shorter than the positive and negative pins in the charger DC plug. In the event the charger plug is pulled from the receptacle while the charger is in operation, the computer communication link will be disconnected first which will shut the charger off before the positive and negative pins disconnect. This will help prevent possible damage to the plug and receptacle due to arcing.

BATTERY WARNING LIGHT

The PowerDrive System 48 vehicle features a dash-mounted battery warning light (above steering column) which, when vehicle is in operation, indicates low battery voltage, or, when vehicle is being charged, indicates a charging problem. The battery warning light is controlled by the PowerDrive System 48 onboard computer.

When the batteries receive an incomplete charge because 1) DC power cord is disconnected, 2) AC power to charger is interrupted, 3) automatic charger shut-off occurs after 16 hours of operation, or 4) charger malfunctions, the warning light will indicate as follows:

- The warning light will not illuminate if the charge is 90% or more complete. The onboard computer will retain in memory the amount of charge needed to fully replenish the batteries and will complete the charge during the next charge cycle.
- When the charger DC cord is unplugged, the warning light will illuminate and remain illuminated for 10 seconds if the charge is less than 90% complete but the vehicle has enough power for 60 minutes of operation. This will alert the fleet operator that the vehicle may be used, but it must be charged to completion as soon as possible.
- The warning light will repeatedly illuminate for 10 seconds, at 4 second intervals, if the charger times out at 16 hours and the batteries are not sufficiently charged. This indicates an abnormal charge cycle. The charger and batteries should be checked by your Club Car distributor/dealer.
- The warning light will repeatedly illuminate for 10 seconds, at 4 second intervals, during a charge cycle (DC plug is still connected) if AC power to the charger is interrupted. The warning light will go out when AC power is restored.

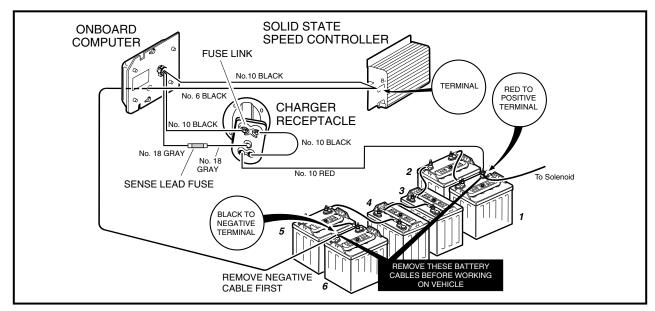


Figure 14-2 Charge Circuit and Battery Configuration - DS, Turf 1, Carryall 1 and Villager 4 Vehicle

THE CHARGE CIRCUIT

For vehicles with a charger receptacle:

The vehicle charge circuit consists of the charger receptacle, fuse link, onboard computer, and the batteries. The negative terminal of the receptacle is connected to the onboard computer. The 10 gauge black wire from the onboard computer connects to the B— terminal on the speed controller, and the 6 gauge black wire (also on the controller B— terminal) goes through the onboard computer and connects to the negative (—) post of battery No. 6. The positive terminal of the charger receptacle is connected to the positive post of battery No. 1. The gray wire (sense lead) from the charger receptacle is connected to the sense lead fuse, which is connected to the gray wire from the onboard computer. If the charger works with one vehicle, but does not work

with another, then most likely the problem is in the vehicle charge circuit. Check the connections between the 18 gauge gray wire from the charger receptacle, the sense lead fuse, and the 18 gauge gray wire from the onboard computer. Also check connections of the fuse link located on the charger receptacle (Figure 14-2 or 14-3, Page 14-3).

For vehicles without a charger receptacle:

The vehicle charge circuit consists of the onboard charger, onboard computer, and the batteries. The black wire from the charger is connected to the terminal block. The 10 gauge black wire from the onboard computer connects to the terminal block, and the 6 gauge black wire (also on the controller B- terminal) goes through the onboard computer and connects to the negative (-) post of battery No. 6. The red wire of the charger is connected to the solenoid large post. The blue wire (sense lead) from the charger is connected to the sense lead fuse, which is connected to the gray wire from the onboard computer (Figure 14-4, Page 14-4).

To check the charge circuit, check the connections between the 10 or 18 gauge gray wire from the OBC, the sense lead fuse, and the wire connections on the batteries.

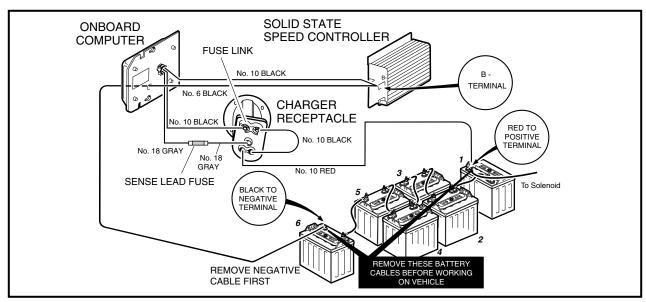


Figure 14-3 Charge Circuit and Battery Configuration - Turf 2, Carryall 2 and Villager 6 and 8 Vehicles

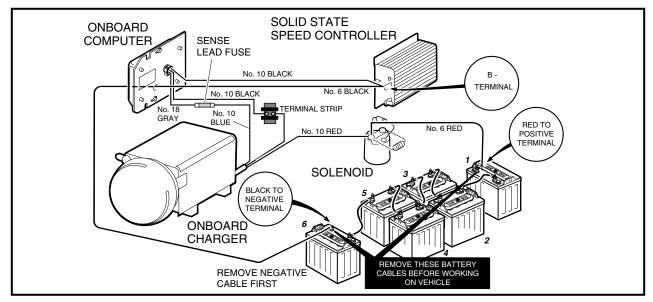


Figure 14-4 Charge Circuit and Battery Configuration - Carryall 6 and TransPorter Vehicles

CHARGER INSTALLATION AND USE

Read DANGER and WARNING on page 14-1.

WARNING

- DO NOT BYPASS THE SENSE LEAD FUSE!
- DISCONNECT BOTH THE AC AND DC PLUGS BEFORE WORKING ON THE CHARGER OR CHANGING THE CHARGER CORD.
- TO CONNECT THE CHARGER PLUG TO THE VEHICLE RECEPTACLE, GRASP THE PLUG AND PUSH IT STRAIGHT INTO THE RECEPTACLE. DO NOT ROCK OR BEND THE PLUG.
- TO DISCONNECT THE CHARGER FROM THE VEHICLE RECEPTACLE, GRASP THE PLUG AND PULL IT STRAIGHT OUT OF THE RECEPTACLE. DO NOT PULL ON THE CORD. DO NOT TWIST, ROCK, OR BEND THE PLUG.
- DO NOT CONNECT THE CHARGER TO BATTERY PACKS THAT ARE NOT COMPATIBLE WITH THE DC OUTPUT VOLTAGE SPECIFIED ON THE CHARGER. OVERHEATING AND TRANSFORMER BURNOUT WILL RESULT.
- DO NOT USE THE CHARGER IF THE PLUG, CORD, OR RECEPTACLE HAVE BEEN DAMAGED IN ANY WAY. USE OF THE CHARGER WITH ANY OF THESE CONDITIONS COULD RESULT IN A FIRE, PROPERTY DAMAGE, PERSONAL INJURY, OR DEATH.
- DO NOT USE THE CHARGER IF:
 - THE DC PLUG DOES NOT MAKE A GOOD CONNECTION.
 - THE PLUG AND RECEPTACLE FEEL HOTTER THAN NORMAL.
 - THE PLUG PINS OR RECEPTACLE CONTACTS ARE BENT OR CORRODED.
 - THE PLUG, RECEPTACLE, OR CORDS ARE CUT, WORN, OR HAVE ANY EXPOSED WIRES.
 - THE PLUG, CORDS, CHARGER, OR RECEPTACLE ARE DAMAGED.
- USING THE CHARGER WITH ANY OF THE ABOVE CONDITIONS COULD RESULT IN FIRE, PERSONAL INJURY OR PROPERTY DAMAGE. REPAIR OR REPLACE WORN OR DAMAGED PARTS BEFORE USING THE CHARGER.
- EACH CHARGER SHOULD HAVE ITS OWN 15 OR 20 AMPERE BRANCH CIRCUIT PROTECTION (CIRCUIT BREAKER OR FUSE), IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE ANSI/NFPA 70, AND LOCAL CODES AND ORDINANCES. IMPROPER AC SUPPLY CIRCUIT PROTECTION MAY RESULT IN A FIRE.

Each PowerDrive System 48 electric vehicle is supplied with either a fully automatic, external battery charger or fully automatic onboard charger as standard equipment.

To reduce risk of electric shock, the battery charger must be grounded. The charger is equipped with an AC electric cord with an equipment-grounding conductor and grounding type plug. It is for use on a nominal 120-volt, 60-hertz single-phase circuit. The AC plug must be connected to an appropriate receptacle that is properly installed and grounded in accordance with the National Electric Code and all local codes and ordinances.

The use of an extension cord with the charger is not recommended. If an extension cord must be used, use a three-conductor No. 12 AWG cord with ground, properly wired and in good electrical condition. Keep it as short as possible (no more than twelve feet). Place all cords so they will not be stepped on, tripped over, or otherwise subject to damage or stress. **See following WARNING**.

Provide adequate ventilation for the charger. Keep all charger ventilation openings at least two inches away from walls and other objects. **See following WARNING.**

WARNING

- IMPROPER CONNECTION OF THE EQUIPMENT-GROUNDING CONDUCTOR CAN RESULT IN AN ELECTRICAL SHOCK.
- DO NOT USE AN ADAPTER TO PLUG CHARGER INTO A TWO-BLADE OUTLET OR EXTENSION CORD. EXTENSION CORD OR OUTLET MUST ACCEPT GROUNDED THREE-BLADE PLUG.THE USE OF AN IMPROPER EXTENSION CORD COULD RESULT IN FIRE OR ELECTRIC SHOCK.
- DO NOT OPERATE THE CHARGER IF IT HAS RECEIVED A SHARP BLOW, WAS DROPPED, OR WAS OTHERWISE DAMAGED. MAKE SURE IT IS OPERATING PROPERLY BEFORE PUTTING IT BACK IN USE.
- DO NOT ALLOW CLOTHING, BLANKETS, OR OTHER MATERIALS TO COVER THE CHARGER.
- CHARGERS CAN IGNITE FLAMMABLE MATERIALS AND VAPORS. DO NOT USE NEAR FUELS, GRAIN DUST, SOLVENTS, THINNER, OR OTHER FLAMMABLES.
- KEEP CHARGER DRY DO NOT EXPOSE TO RAIN, STORE INDOORS.

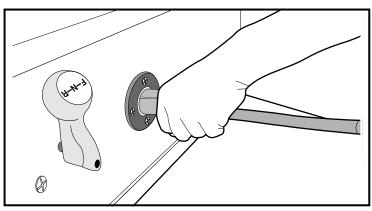


Figure 14-5 Charger Receptacle

Normal Charger Operation

- 1. With the charger DC output cord disconnected from the batteries, connect the power supply cord to a 120-volt, 60-hertz, single-phase outlet.
- 2. Connect the charger DC plug to the vehicle charger receptacle located on the seat support panel near the driver's knee (Figure 14-5, Page 14-6). The charger will activate automatically within 2 to 15 seconds after the DC plug is connected.
- 3. Monitor the ammeter for the correct charge rate. The initial charge rate will vary from 15 to 19 amps, depending upon the condition and depth of discharge of the batteries. Slight variations in the initial charge rate may also result from AC line input voltages which are higher or lower than 120 volts. Higher line voltages increase the initial charge rate while lower line voltages reduce the initial charge rate.
- 4. Monitor the ammeter for about 30 seconds. Under normal operating conditions (when the charger is plugged into a vehicle with discharged batteries), the ammeter will drop to zero for 2 to 3 seconds at the beginning of each charge cycle in order to perform a self-diagnostic test. This test will be repeated at one hour and two hours into the charge. **See following NOTE.**

NOTE

- IF THE BATTERIES ARE IN A FULLY CHARGED STATE AND THE VEHICLE HAS NOT BEEN DRIVEN, THE ONBOARD COMPUTER WILL NOT PERFORM THE SELF-DIAGNOSTIC TEST.
- WHEN AIR TEMPERATURES FALL BELOW 65°F (18.3°C), BATTERIES CHARGED IN UNHEATED AREAS SHOULD BE PLACED ON CHARGE AS SOON AS POSSIBLE AFTER USE. COLD BATTERIES REQUIRE MORE TIME TO FULLY CHARGE.

Testing Charger Operation

- 1. With the DC plug disconnected from the vehicle charger receptacle, insert the AC cord into an outlet. The charger relay should NOT close. A multimeter set to volts DC and connected across the DC plug positive (+) and negative (–) pins should indicate zero volts. No transformer hum should be heard.
- 2. Unplug the AC cord from its outlet and connect the DC plug to the receptacle. The charger relay should close with an audible "click" after a 2 to 15 second delay.
- 3. If the charger does not operate as in steps 1 or 2 above, refer to the wiring diagram (Figure 14-6, Page 14-7 or Figure 14-25, Page 14-28) and make sure the charger is wired correctly.

Always monitor the first charge cycle to ensure the charger turns off properly. If the DC cord is disconnected during a charge, and the batteries are less than 90% charged, the battery warning light will illuminate intermittently. See Battery Warning Light, Page 14-3.

CHECKING BATTERY CONDITION AFTER A CHARGE CYCLE

Read DANGER and WARNING on page 14-1.

It is common practice for technicians to check the condition of a set of batteries after they have charged to ensure they have received a complete charge before the vehicle is used. With the PowerDrive System 48 this practice is not necessary. The onboard computer controls and monitors the charge cycle. If any problem occurs during a charge cycle, the battery warning light, located above the steering column in the center dash panel, will illuminate intermittently. If the battery warning light is illuminated after a charge cycle, refer to the Troubleshooting Charts on pages 14-9 through 14-12. If the specified test procedures identify no problems, plug the DC cord into the vehicle and let it charge until the charger shuts off automatically. If a problem is found, correct it and then charge the vehicle. Normal voltage toward the end of a charge cycle should be approximately 59 to 63 volts while the charger is still operating.

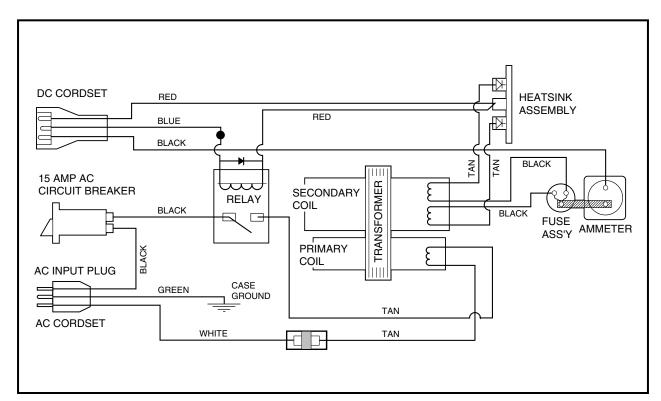


Figure 14-6 PowerDrive Battery Charger Wiring Diagram (Stationary Charger)

Start Charge Cycle

- 1. Disconnect the DC plug from the vehicle's charger receptacle.
- 2. Wait 20 seconds, then reconnect the DC cord back into the vehicle receptacle. **See following NOTE**.

NOTE

- THE CHARGER WILL NOT OPERATE UNLESS A DELAY OF APPROXIMATELY 20 SECONDS IS OBSERVED.
- 3. Monitor the ammeter for the charge rate. If the vehicle has not been driven since the last charge cycle and the batteries are fully charged, the onboard computer will not perform a self-diagnostic test. The charge cycle will begin and the ammeter will not drop to zero. If the vehicle has been driven, even only a few feet, the onboard computer will perform the self-diagnostic test; the ammeter will drop to zero for 2 to 3 seconds before the charge cycle begins.

WARNING

• KNOWLEDGE OF BATTERY CHARGER WIRING AND COMPONENT TERMINOLOGY IS REQUIRED BEFORE ATTEMPTING ANY REPAIR. (FIGURE 14-6, PAGE 14-7 AND FIGURE 14-7, PAGE 14-8, PAGE 14-8) (FIGURE 14-25, PAGE 14-28 FOR ONBOARD CHARGER).

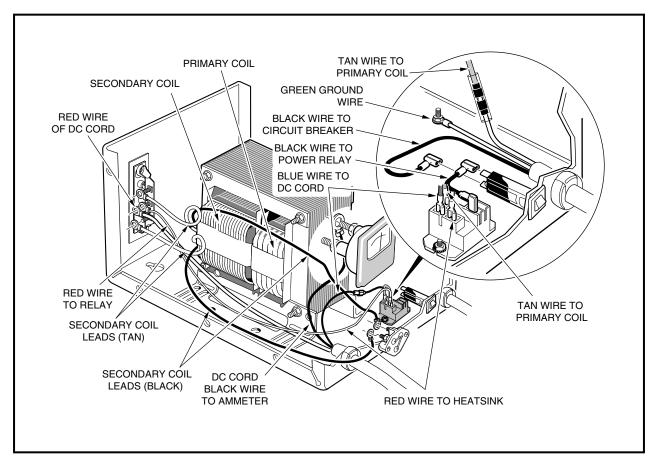


Figure 14-7 PowerDrive Battery Charger

TROUBLESHOOTING

Read DANGER and WARNING on page 14-1.

Use the following information (Pages 14-9 through 14-12) as a guide for troubleshooting PowerDrive System 48 vehicles. The Troubleshooting Guide on pages 14-9 and 14-9 encompasses the entire battery charging circuit. The flow chart on pages 14-11 and 14-12 refers specifically to the onboard computer and battery charger. Test procedures specified in the Guide and chart can be found on the pages immediately following. **See also Troubleshooting the Onboard Charger on page 14-29.**

POWERDRIVE BATTERY CHARGER TROUBLESHOOTING GUIDE							
SYMPTOM		POSSIBLE CAUSES		REFER TO			
1.	Relay does not close, no transformer hum and ammeter does not move.	1)	Batteries disconnected.	Section 13–Batteries.			
		2)	Battery voltage is too low.	Test Procedure 1, Page 14-13			
		3)	Poor connection between plug and receptacle.	Test Procedure 1, Page 14-13			
		4)	DC plug and cord.	Test Procedures 1 and 5, Page 14-13 and Page 14-16			
		5)	Onboard computer malfunction.	Test Procedure 2, Page 14-13			
		6)	Gray sense lead fuse is blown.	Test Procedure 1, Page 14-13			
		7)	Receptacle fuse link is blown.	Section 12–Electrical Components.			
2.	Relay closes with an audible click but no transformer hum and ammeter does not move.	1)	Improper AC outlet voltage.	Test Procedure 3, Page 14-14			
		2)	Failed AC plug and cord.	Test Procedure 3, Page 14-14			
		3)	Internal AC breaker.	Test Procedure 3, Page 14-14			
		4)	Transformer primary coil.	Test Procedure 6, Page 14-16			
		5)	Relay	Test Procedure 8, Page 14-18			
3.	Relay closes and transformer hums but ammeter does not move.	1)	Blown charger fuse.	Test Procedure 4, Page 14-15			
		2)	Both diodes failed.	Test Procedure 4, Page 14-15			
		3)	Onboard computer malfunction.	Test Procedure 2, Page 14-13			
		4)	Failed transformer.	Test Procedure 6, Page 14-16			
4.	Relay operates intermittently.	1)	Blown fuse on red lead from OBC.	Section 11–Electrical System and Testing.			
		2)	Failed charger relay.	Test Procedure 8, Page 14-18			

POWERDRIVE BATTERY CHARGER TROUBLESHOOTING GUIDE						
SYMPTOM			POSSIBLE CAUSES	REFER TO		
5.	Single charger fuse link blows.	1)	Diode failed.	Test Procedure 4-A, Page 14-15		
		2)	Loose internal fuse connection.	Tighten connection		
6.	Both charger fuse links blow or receptacle fuse link blows.	1)	Battery is wired in reverse polarity.	Test Procedure 4-B, Page 14-15		
		2)	DC cord is wired in reverse polarity.	Test Procedure 4-B, Page 14-15		
		3)	Both diodes failed.	Test Procedure 4-B, Page 14-15		
7.	Charger output is low.	1)	One diode failed.	Test Procedure 4-A, Page 14-15		
		2)	Transformer coil short-circuit failure.	Test Procedure 6, Page 14-16		
		3)	Onboard computer malfunction.	Test Procedure 2, Page 14-13		
8.	Charger turns off too soon.	1)	AC power supply was shut off.	Test Procedure 3, Page 14-14		
		2)	Onboard computer malfunction.	Test Procedure 2, Page 14-13		
		3)	Batteries may be fully charged.	Test Procedure 7, Page 14-17		
9.	Charger goes to 16 hour time out.	1)	Onboard computer malfunction.	Test Procedure 2, Page 14-13		
		2)	Extremely discharged batteries or cold temperature.	Recharge batteries.		
		3)	Failed or weak battery.	Section 13-Batteries		
10.	AC line fuse or circuit breaker blows.	1)	AC cord is shorted.	Test Procedure 8, Page 14-18		
		2)	Failed transformer.	Test Procedure 6, Page 14-16		
11.	Battery trouble light illuminates for ten seconds at four second intervals (with DC charger cord plugged in)	1)	AC power interrupted.	Test Procedure 3, Page 14-14		
		2)	Onboard computer malfunction.	Test Procedure 2, Page 14-13		
		3)	Charger failure.	See Testing Charger Operation on page 14-7		
		4)	16 hour time out.	See Battery Warning Light on page 14-3		
		5)	Battery or batteries need to be replaced.	Section 13-Batteries		
12.	Battery trouble light illuminates for ten seconds at four second intervals (with DC charger cord unplugged)	1)	Batteries are getting close to full discharge capacity.	Recharge batteries (golf round may be completed first).		
		2)	Onboard computer malfunction.	Test Procedure 2, Page 14-13		
		3)	Battery or batteries need to be replaced.	Section 13-Batteries		

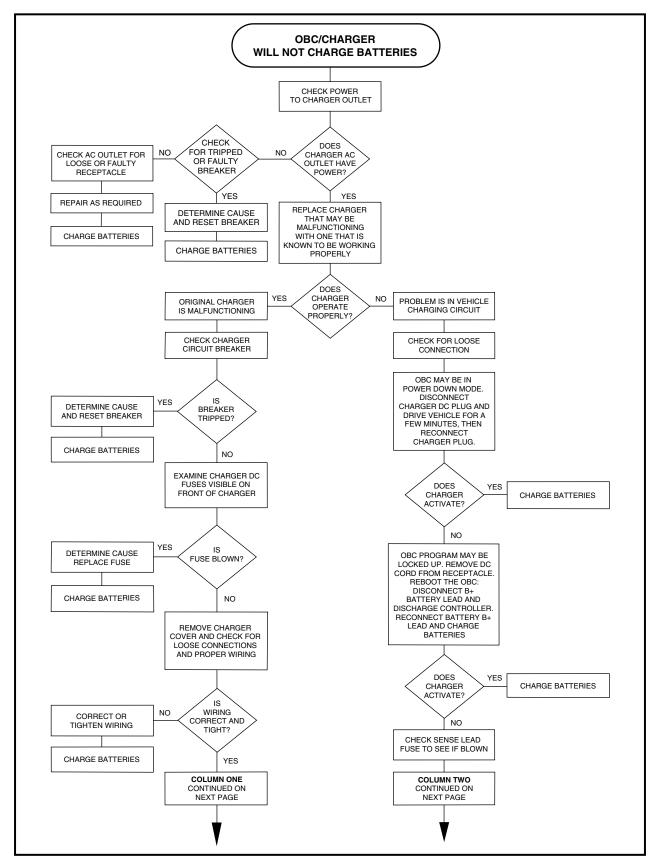


Figure 14-8 Flow Chart

14 POWERDRIVE BATTERY CHARGER Test Procedures

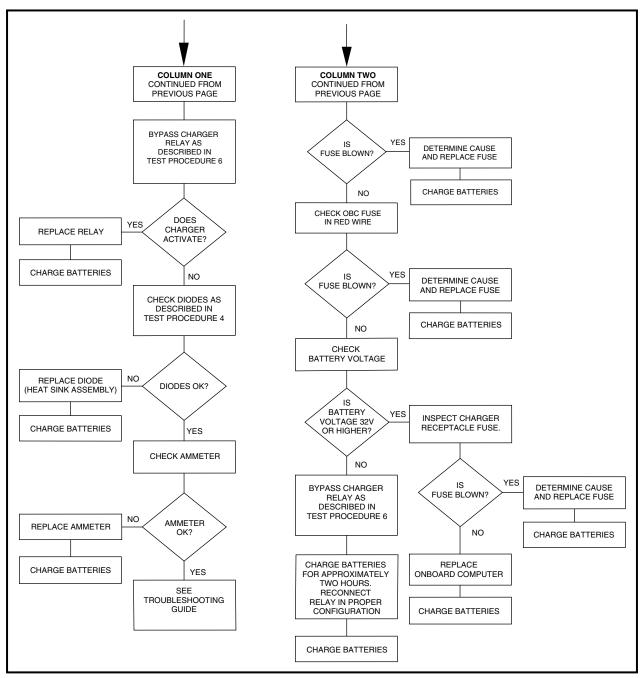


Figure 14-9 Flow Chart, Continued

TEST PROCEDURES

Read Danger and Warning on page 14-1.

GENERAL INFORMATION

The charger uses DC battery voltage through the onboard computer to close the charger relay which activates the charger AC circuit. When the charger is operating properly, there is a 2 to 15 second delay after the DC cord is plugged into the vehicle before the relay closes. This delay allows time for the DC plug to make a secure connection with the receptacle before the AC circuit is activated and AC power is supplied to the pri-

mary coil of the transformer. When the relay closes an audible "click" can be heard, and then as power is supplied, the transformer should hum and the ammeter should indicate the charge rate.

INDEX OF TEST PROCEDURES

- 1. Battery Voltage is Too Low or Faulty Connection Between Plug and Receptacle (Stationary Charger Only)
- 2. Onboard Computer
- 3. AC Power and Continuity Check of AC Circuit
- 4. Diodes
- 5. Charger DC Circuit Continuity Test (Stationary Charger Only)
- 6. Transformer
- 7. Battery State of Charge
- 8. Continuity

Test Procedure 1– Battery Voltage is Too Low or Faulty Connection Between Plug and Receptacle (Stationary Charger Only)

Read Danger and Warning on page 14-1.

- 1. Check the DC plug and vehicle receptacle for damage, dirt, corrosion, or any condition that might prevent a sound electrical connection.
- 2. Inspect the receptacle contacts to ensure they are not damaged and they are firmly seated within receptacle.
- 3. Check the wire connections to the charger receptacle:
 - 3.1. Verify the 10 gauge red wire from the charger receptacle is connected to the positive post of battery No. 1 (Figure 14-10, Page 14-14 and Figure 14-11, Page 14-14).
 - 3.2. Make sure the two nuts that secure the two 10 gauge black wires to the receptacle fuse assembly are tight (Figure 14-12, Page 14-14).
 - 3.3. Check connections at the 18 gauge gray wire from the receptacle to the sense lead fuse, and from the sense lead fuse to the onboard computer gray wire.

A WARNING

- DO NOT BYPASS THE SENSE LEAD FUSE!
 - 3.4. Remove the gray sense lead fuse assembly and check its continuity with a multimeter set to 200 Ω (ohms). The resistance should be less than 2 Ω (ohms).
- 4. With a multimeter set to 200 volts DC, measure the voltage of the battery pack between the positive post of battery No. 1 and the negative post of battery No. 6 (Figure 14-10, Page 14-14 or Figure 14-11, Page 14-14). Normal no-load voltage will be 50 to 52 volts for fully charged batteries. The voltage of the battery pack must be over 32 volts DC to allow the onboard computer to close the charger relay. If battery pack voltage is too low to start charger, see Charging a Battery Pack that has Low Voltage, Page 14-26.

Test Procedure 2- Onboard Computer

Read Danger and Warning on page 14-1.

- 1. Check the AC circuit breaker on the front of the charger and reset if necessary.
- Select a second charger that is normally connected to another vehicle and is known to operate properly. Leave the AC cord of the second charger connected to the AC outlet that it normally is connected to. This will ensure that AC power is present.

Test Procedure 2, Continued:

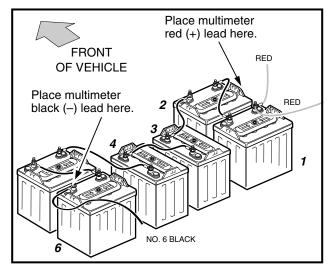


Figure 14-10 Battery Pack - DS, Turf 1, Carryall 1 and Villager 4 Vehicles

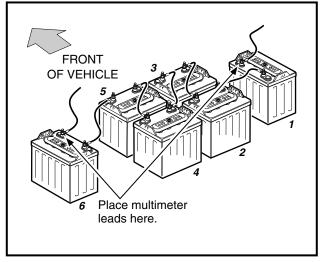


Figure 14-11 Battery Pack - Turf 2, Carryall 2 and 6, Villager 6 and 8 and TransPorter Vehicles

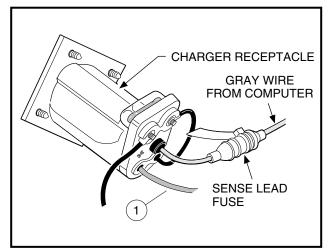


Figure 14-12 Receptacle Wire Connections

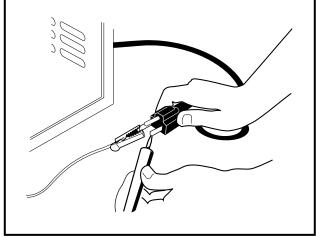


Figure 14-13 Test AC Cord

- 3. Insert the DC cord from the second charger into the receptacle of the vehicle that is not charging properly.
- 4. If the second charger fails in the same manner as the first charger, then the vehicle charging circuit is not functioning properly. **See Troubleshooting**, **Page 14-9**.
- 5. Connect the first charger into another vehicle that is known to be functioning properly. If the charger performs as it should, then the charger is not in need of repair.

Test Procedure 3– AC Power and Continuity Check of AC Circuit Read Danger and Warning on page 14-1.

- 1. Disconnect the AC power supply cord from the outlet and the DC plug from the vehicle receptacle.
- 2. Check the AC circuit breaker on the front of the charger and reset it if necessary.
- 3. Check the AC line fuse or circuit breaker in the storage facility.
- 4. With a multimeter set at 500 volts AC, check incoming AC voltage. Insert blades into outlet; voltage should be 105 to 128 volts. If proper voltage is not present, have building wiring checked by a licensed electrical contractor.

- 5. Check continuity of the AC circuit:
 - 5.1. Remove the charger cover.
 - 5.2. Disconnect the tan lead (from the primary coil) and the black lead (from the AC circuit breaker) from the charger relay. Connect the tan lead to the AC circuit breaker (Figure 14-18, Page 14-18).
 - 5.3. With relay bypassed, there should be continuity across the AC cord blades (Figure 14-13, Page 14-14).
- 6. If the circuit is not complete, check the wiring of the AC cord, transformer primary coil leads, internal AC circuit breaker, and jumper wire (Figure 14-18, Page 14-18).
- 7. If the charger is wired correctly, check the continuity of the AC cord, transformer primary coil, and the jumper wire individually (**Test Procedure 8**, **Page 14-18**).

Test Procedure 4– Diodes

Use test procedure 4A for single diode failures and testing of individual diodes. If both diodes have failed, use test procedure 4B.

Test Procedure 4A – Single Diode Failure

Read Danger and Warning on page 14-1.

A single diode failure is indicated by one fuse link blowing (closed circuit diode) or by the charger output being low (open circuit diode). If a diode has failed, the entire heatsink assembly must be replaced. To check diodes:

- 1. Disconnect AC cord from its outlet and DC plug from the receptacle, then remove the charger cover.
- 2. Disconnect one transformer secondary coil lead from the diode terminal (Figure 14-14, Page 14-16).
- 3. Using a low voltage continuity tester or multimeter set to the diode test function, connect the red (+) tester lead to the diode mounting plate and the black (–) tester lead to a diode terminal and note the reading (Figure 14-14, Page 14-16).
- 4. Reverse tester leads and check each diode again and note the reading (Figure 14-15, Page 14-16). A diode is designed to conduct current in one direction only. If a diode conducts current (shows continuity) in both directions, the entire heatsink assembly with diodes must be replaced. If a diode does not conduct current (does not show continuity) in either direction, the entire heatsink assembly must be replaced.
- 5. On rare occasions, a single fuse link may melt due to excessive heat. This can be caused by a loose internal fuse connection. Check all three fuse connections inside the charger to be sure they are clean and tight. The proper torque on the fuse link connections is 20 in-lb (2.2 N-m).
- 6. Be sure the charger is wired properly and all connections are clean and tight. See following WARNING.

A WARNING

• IF CONNECTIONS ARE NOT CLEAN AND TIGHT, EXCESSIVE HEAT COULD RESULT WHICH MAY DAMAGE THE CHARGER.

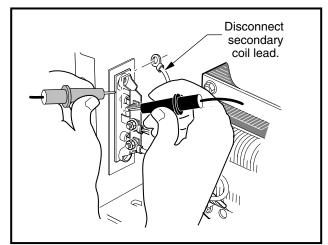
Test Procedure 4B Both Diodes Fail

Read Danger and Warning on page 14-1.

To check the diodes, use diode test procedure 4A. If both diodes have failed closed, both charger fuse links will be blown. If both diodes have failed open, the relay will close and the transformer will hum, but the ammeter will not indicate any output and the AC circuit breaker may trip off. If both diodes have failed open or closed, the entire heatsink assembly must be replaced. To determine why both diodes failed:

1. Check the batteries and the receptacle to be sure they are wired in the correct polarity. Also check the voltage and polarity at the receptacle.

Test Procedure 4B, Continued:



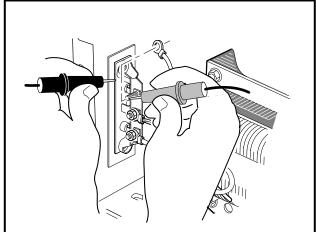


Figure 14-14 Diode Test

Figure 14-15 Diode Test, Reverse Probe Position

- 2. Make sure the charger DC plug is wired correctly; the red wire should be connected to the center terminal of the heatsink assembly, the blue wire should be connected to the relay coil, and the black wire should be connected to the left side of the ammeter (when viewed from inside the charger). If a reverse polarity connection is made between the charger and the batteries, both fuse links will blow when the DC cord is plugged into the vehicle, whether or not the AC cord is plugged into an outlet.
- 3. On rare occasions, both diodes may fail due to a lightning strike at the charging location.
- 4. Excessive heat due to a loose connection may also cause both fuse links to melt. Be sure fuse connections are tightened to 20 in-lb (2.2 N-m).
- 5. Be sure the charger is wired properly and all connections are clean and tight.

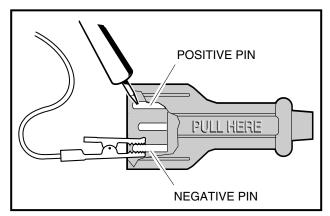
Test Procedure 5– Charger DC Circuit Continuity Test (Stationary Charger Only) Read Danger and Warning on page 14-1.

- Using a continuity tester (Club Car Part No. 1011273) or multimeter set to 200 Ω (ohms), connect the
 test leads to the pins marked (+) and (–) on the DC plug (Figure 14-16, Page 14-17) and note the readings.
- 2. Reverse the test leads and check the DC plug again (Figure 14-17, Page 14-17). The circuit should show continuity in only one direction.
- 3. If the circuit does not show continuity in either direction and the charger fuse is not blown, individually check the continuity of the DC plug and cord (Test Procedure 8), ammeter (Test Procedure 8), diodes (Test Procedure 4A), and all connections.
- 4. If the circuit shows continuity in both directions, a short circuit exists in the charger DC circuit, usually caused by failed diodes (Test Procedure 4). If diodes have not failed, check the DC output cord for a short circuit as described in Test Procedure 8.
- Remove blue wire from the red wire connected to the charger relay and check continuity between the positive and negative pins and middle pin on the DC plug (Figures 14-6 and 14-7, Pages 14-7 and 14-8).
 There should be no continuity.

Test Procedure 6– Transformer

Read Danger and Warning on page 14-1.

Failure of the transformer may be caused by aging or a short circuit in adjacent coil turns. If the transformer has failed, ammeter would indicate low output or no output; however, the transformer may hum. A blown AC line fuse or circuit breaker in the charger and/or storage facility may be caused by a failed transformer. To test the transformer:



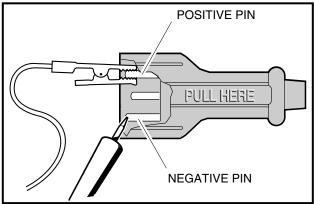


Figure 14-16 DC Plug Test Leads

Figure 14-17 DC Plug Reverse Test Leads

- 1. Disconnect transformer secondary coil lead Nos. 1 and 5 from the heatsink assembly (Figure 14-18, Page 14-18 or Figure 14-31, Page 14-30).
- 2. To apply AC power directly to the transformer primary coil, the relay must be bypassed.
 - 2.1. To bypass the relay, remove the black wire (3) from the AC circuit breaker and disconnect the tan wire (4) from the relay. Connect the tan wire to the AC circuit breaker (Figure 14-18, Page 14-18 or Figure 14-31, Page 14-30). See following DANGER.

A DANGER

- DO NOT ALLOW SECONDARY COIL LEADS TO TOUCH ONE ANOTHER. THERE ARE APPROXIMATELY 120 VOLTS PRESENT.
- Be sure the secondary coil leads are not touching one another. With the relay bypassed, insert the AC plug into an outlet. If the AC line fuse or circuit breaker blows, the transformer is shorted internally and must be replaced.
- 4. If AC line fuse or circuit breaker does not blow, check transformer secondary voltage across lead Nos.1 and 5 using a multimeter set to 500 volts AC. If measured voltages are approximately 85 volts AC or lower for the secondary coil, the transformer is shorted internally and must be replaced (Figure 14-18, Page 14-18 or Figure 14-31, Page 14-30).
- 5. If the transformer output measurements are 86 volts AC or higher, disconnect AC plug from its outlet.
- 6. If voltage readings are normal, transformer is operational. See Test Procedure 5 for further tests of the DC circuit.

Test Procedure 7- Battery State of Charge

Read Danger and Warning on page 14-1.

- 1. After the charger has shut off, disconnect DC charger plug for approximately 20 seconds and then reconnect it. The ammeter should jump to 14 to 18 amps and then taper to below 5 amps within 15 minutes. If it does taper to below 5 amps within 15 minutes, batteries are fully charged and charger is functioning properly.
- 2. If the charger does not taper to below 5 amps within 15 minutes, batteries may not be receiving a full charge and the onboard computer should be checked. **See Test Procedure 2.**

NOTE

• OLD BATTERIES NEAR THE END OF USEFUL SERVICE MAY NOT TAPER TO BELOW 5 AMPS. SEE SECTION 13-BATTERIES.

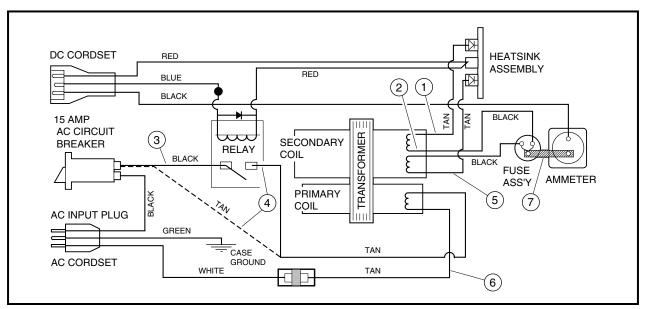


Figure 14-18 Transformer Test Wiring Diagram

Test Procedure 8– Continuity

Read Danger and Warning on page 14-1.

AC Cord and Plug

Check continuity of the AC cord (Figure 14-19, Page 14-19).

- Disconnect the AC cord from the outlet and the DC plug from the receptacle, then remove the charger cover.
- 2. Disconnect black wire (1) of AC cord from charger AC circuit breaker (3) (Figure 14-19, Page 14-19).
- 3. Disconnect green wire (2) from charger case and position it so it does not touch any metal part of the charger (Figure 14-19, Page 14-19).
- 4. Using a multimeter set for 200 Ω (ohms), place the red probe on the terminal at the end of the black wire (1) **(Figure 14-19, Page 14-19)**. Test for continuity on each of the flat blades and then on the round pin of the AC plug. Continuity should register on one flat blade only. If any other reading is obtained, the AC cord and plug must be replaced.
- 5. Put the red probe on the end of the green wire (2) and with the black probe check for continuity on both flat blades and on the round pin of the AC plug (Figure 14-19, Page 14-19). Tester should register continuity on only the round pin. If any other reading is obtained, the AC cord and plug must be replaced.
- 6. Disconnect the white wire (4) from the tan wire (Figure 14-19, Page 14-19). Put red probe on the white wire and check for continuity on both flat blades and on the ground pin of the AC plug (Figure 14-19, Page 14-19). Tester should register continuity on only one flat blade. If any other reading is obtained, the AC cord and plug must be replaced.

DC Cord and Plug

Stationary Charger Only:

- Disconnect the AC cord from the outlet and the DC plug from the receptacle, then remove the charger cover.
- 2. To check the continuity of the DC cord, disconnect the black wire of the DC cord from the ammeter (Figure 14-20, Page 14-21).
- 3. Disconnect the red wire of the DC cord from the heatsink assembly (Figure 14-20, Page 14-21).

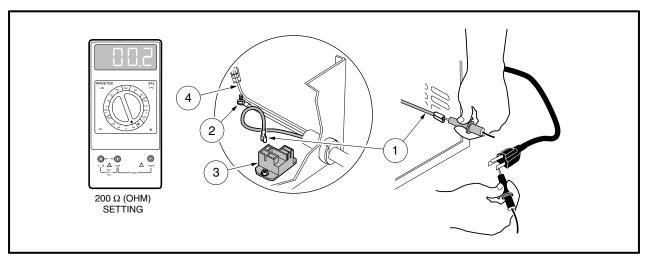


Figure 14-19 AC Cord and Plug Continuity Test

- 4. Disconnect the blue wire from the red wire assembly that connects to the charger relay (Figure 14-20, Page 14-21).
- 5. Place the clip of the continuity tester on the red wire of the DC cord (Figure 14-20, Page 14-21).
- 6. Place the continuity tester probe on the positive (+) pin of the DC plug (the positive (+) and negative (–) pins are identified on the plug). If tester does not register continuity, cord and plug must be replaced.
- 7. Place the continuity tester probe on the negative (–) pin of the DC plug. Tester should register no continuity. If tester registers continuity, cord and plug must be replaced.
- 8. Place the continuity tester probe on the unmarked (middle) pin of the DC plug. Tester should register no continuity. If tester registers continuity, cord and plug must be replaced.
- 9. Move the continuity tester clip to the black wire of the DC cord (Figure 14-20, Page 14-21).
- 10. Place the continuity tester probe on the negative (–) pin of the DC plug. Tester should register continuity. If tester does not register continuity, cord and plug must be replaced.
- 11. Place the continuity tester probe on the unmarked (middle) pin of the DC plug. Tester should register no continuity. If tester registers continuity, cord and plug must be replaced.
- 12. Move continuity tester clip to blue wire of DC cord (Figure 14-20, Page 14-21). Check for continuity at middle pin. Tester should register continuity. If tester does not register continuity, replace DC cord.

Transformer

WARNING

• BEFORE PERFORMING TEST, BE SURE AC PLUG IS NOT CONNECTED TO AN AC OUTLET.

The PowerDrive battery charger transformer has two coils; a primary coil and a secondary coil (Figure 14-18, Page 14-18).

Primary Coil

- 1. Disconnect both AC and DC cords and remove charger cover. See preceding WARNING.
- 2. Disconnect terminals from transformer (tan) primary leads (4) and (6) (Figure 14-18, Page 14-18).
- 3. Place the continuity tester leads on the disconnected primary coil leads. Tester should register continuity. If tester does not register continuity, replace the transformer.

Secondary Coil

1. Disconnect both AC and DC cords and remove charger cover. See preceding WARNING.

Transformer, Continued:

2. Remove the transformer (tan) secondary coil lead (1) from the upper terminal of the heatsink assembly (Figure 14-18, Page 14-18). See following DANGER.

A DANGER

- DO NOT ALLOW SECONDARY COIL LEADS TO TOUCH ONE ANOTHER. THERE ARE APPROXIMATELY 120 VOLTS PRESENT.
- 3. Remove the other transformer (tan) secondary coil lead (5) from the bottom terminal of the heatsink assembly and place the tester clip on the ammeter bus bar (7) (Figure 14-18, Page 14-18). Place the continuity leads on each (tan) secondary coil lead. Tester should register continuity. If tester does not register continuity, replace transformer. Be sure the fuse is intact and not blown.

Voltage Suppressor - Failed Closed

- 1. Disconnect both AC and DC plugs. See preceding WARNING.
- 2. Connect red (+) lead of multimeter (with alligator clips) to the positive terminal of the DC plug.
- Connect black (-) clip to the sense lead pin (short pin) of the DC plug. With the multimeter set on diode check (audible setting), multimeter should indicate no tone. If a tone is emitted (indicating a closed circuit) then the voltage suppressor has failed and should be replaced. See following NOTE.

NOTE

• FAILURE IN A CLOSED CONDITION CAN ALSO BE DETERMINED BY PLUGGING THE CHARGER INTO A VEHICLE, THEN UNPLUGGING CHARGER AND VISUALLY INSPECTING THE SENSE LEAD FUSE AT THE GRAY WIRE. IF FUSE IS BLOWN, THEN THE VOLTAGE SUPPRESSOR HAS FAILED CLOSED AND BOTH FUSE AND VOLTAGE SUPPRESSOR SHOULD BE REPLACED. THE VOLTAGE SUPPRESSOR CANNOT BE TESTED FOR FAILURE IN AN OPEN CONDITION. FAILURE IN AN OPEN CONDITION WILL HAVE NO AFFECT ON VEHICLE CHARGING OPERATION DUE TO THE EXISTENCE OF A SIMILAR COMPONENT LOCATED IN THE ONBOARD COMPUTER.

Relay

- 1. Disconnect both AC and DC cords and remove charger cover. See preceding WARNING.
- 2. Remove black (3) and tan (4) wires from contact terminals of the relay (Figure 14-18, Page 14-18). Place continuity tester leads on contact terminals of the relay. Tester should register no continuity. If tester registers continuity, the relay contacts are welded shut and the relay must be replaced.
- 3. Place continuity leads on contact terminals of relay. With batteries connected, insert DC plug into receptacle. Tester should register continuity. If tester does not register continuity, relay must be replaced.

Ammeter

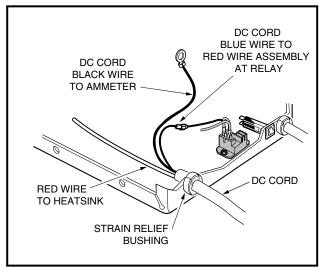
Check continuity of the ammeter:

- Disconnect both AC and DC cords and remove charger cover. See preceding WARNING.
- 2. Disconnect the black wire from the left ammeter post (as viewed from inside the charger).
- 3. Place the continuity tester clip on one of the ammeter posts.
- Place the continuity tester probe on the other ammeter post. The tester should register continuity. If the tester does not register continuity, replace the ammeter.

PLUG AND CORD REPLACEMENT (STATIONARY CHARGER ONLY)

Read DANGER and WARNING on page 14-1.

The charger cord, plug, and receptacle are wear items and should be inspected daily. Visually inspect them for cracks, loose connections, and frayed wiring; they must be replaced when worn or damaged. If charger plug and receptacle show signs of corrosion or are difficult to insert and remove, the receptacle contacts and plug blades may be cleaned with a good electrical contact cleaner or lightly sprayed with WD-40® brand spray lubricant. See Section 12. Page 12-13 for charger receptacle replacement.



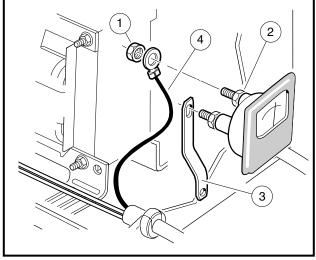


Figure 14-20 DC Cord

Figure 14-21 Charger Cord Replacement

CHARGER CORD AND PLUG REPLACEMENT Read DANGER and WARNING on page 14-1.

Charger Cord and Plug Removal

- 1. Disconnect both AC and DC plugs and remove the charger cover.
- 2. Remove the black lead of the charger DC cord (4) from the ammeter by loosening the nut (1). Support the terminal as the nut is loosened to prevent rotation of the connection (Figure 14-21, Page 14-21).
- 3. Remove nut attaching the red lead of the charger DC cord onto the heatsink assembly.
- 4. Disconnect the DC cord blue wire from the red wire assembly that connects to the charger relay (Figure 14-20, Page 14-21).
- 5. Using pliers, squeeze the strain relief bushing and remove the cord set (Figure 14-20, Page 14-21).

Charger Cord and Plug Installation

- 1. Insert the leads of the new cord through the hole in the charger base.
- 2. Attach the red lead of the new cord set to the center terminal of the heatsink and tighten the nut to 14 in-lb (1.6 N-m) (Figure 14-20, Page 14-21).
- Attach the blue lead of the new cord set to the red wire assembly at the charger relay (Figure 14-20, Page 14-21).
- 4. Attach black lead of new cord to ammeter. Install nut (1) onto post of ammeter slightly more than finger tight. While holding the inside nut (2), tighten the outside nut (1) 1/4 turn (Figure 14-21, Page 14-21).

A CAUTION

- DO NOT ALLOW AMMETER POST TO ROTATE AS THE NUT IS TIGHTENED. IF IT IS ALLOWED TO ROTATE, THE AMMETER COULD BE DAMAGED.
- 5. Using pliers, put the strain relief bushing on the cord and insert it into the charger base.
- 6. Position the charger cover on the base. Install the mounting screws, starting with the bottom holes. Tighten the screws to 11 in-lb (1.2 N-m).

CHARGER REPAIRS

HEATSINK ASSEMBLY

Read DANGER and WARNING on page 14-1.

Heatsink Assembly Removal

- 1. Disconnect the AC and DC cords and remove the charger cover.
- 2. Remove both secondary transformer leads (tan) from the heatsink assembly (Figures 14-6 and 14-7, Pages 14-7 and 14-8).
- 3. Remove the two red wires from the heatsink assembly (Figure 14-6 and 14-7, Pages 14-7 and 14-8).
- 4. Remove the nuts and bolts which secure the heatsink assembly to the case.

Heatsink Assembly Installation

- 1. Place heatsink against charger base. Make sure clear plastic insulator sheet is between the heatsink and the charger base. Install the nuts and bolts which secure the heatsink assembly to the case. Tighten the bolts to 22 in-lb (2.4 N-m) (Figures 14-6 and 14-7, Pages 14-7 and 14-8).
- 2. Connect the red wire from the DC cord and the red wire from the charger relay to the center terminal post on the heatsink assembly. Tighten nut to 18 in-lb (2.0 N-m).
- 3. Connect one of the secondary transformer leads (tan) to the bottom terminal post of the heatsink assembly. Tighten nut to 18 in-lb (2.0 N-m).
- 4. Connect the other secondary transformer lead (tan) to the top terminal post of the heatsink assembly. Tighten nut to 18 in-lb (2.0 N-m).
- 5. Replace charger cover and check charger for proper operation.

TRANSFORMER

Read DANGER and WARNING on page 14-1.

Transformer Removal

- 1. Disconnect the AC and DC cords and remove the charger cover.
- 2. Disconnect the tan primary coil lead from the charger relay, then disconnect the tan primary coil lead from the white wire in the AC cord (Figures 14-6 and 14-7, Pages 14-7 and 14-8).
- 3. Disconnect the two tan secondary transformer leads from the heatsink assembly (Figures 14-6 and 14-7, Pages 14-7 and 14-8).
- 4. Disconnect the two black secondary transformer leads from the fuse assembly (Figures 14-6 and 14-7, Pages 14-7 and 14-8).
- 5. Remove the four bolts and nuts that mount the transformer to the case and remove the transformer (Figures 14-6 and 14-7, Pages 14-7 and 14-8).

Transformer Installation

- 1. Install the transformer with secondary coil to the rear of the charger case. Tighten the four bolts and nuts to 28 in-lb (3.0 N-m) (Figures 14-6 and 14-7, Pages 14-7 and 14-8).
- 2. Connect one secondary transformer lead (tan) to the top terminal post of the heatsink assembly. Tighten nut to 18 in-lb (2 N-m) (Figures 14-6 and 14-7, Pages 14-7 and 14-8).
- 3. Connect the other secondary transformer lead (tan) to the bottom terminal post of the heatsink assembly. Tighten nut to 18 in-lb (2 N-m) (Figures 14-6 and 14-7, Pages 14-7 and 14-8).
- 4. Connect one secondary transformer lead (black) to one terminal of the fuse assembly. Tighten nut to 22 in-lb (2.5 N-m) (Figures 14-6 and 14-7, Pages 14-7 and 14-8).
- 5. Connect the other secondary transformer lead (black) to the remaining terminal of the fuse assembly. Tighten nut to 22 in-lb (2.5 N-m) (Figures 14-6 and 14-7, Pages 14-7 and 14-8).
- 6. Connect the tan primary lead to the charger relay (Figures 14-6 and 14-7, Pages 14-7 and 14-8).
- 7. Connect the other tan primary lead to the white wire from the AC cord (Figures 14-6 and 14-7, Pages 14-7 and 14-8).
- 8. Replace charger cover and check charger for proper operation.

AMMETER

Read DANGER and WARNING on page 14-1.

Ammeter Removal

- 1. Disconnect the AC and DC cords and remove the charger cover.
- 2. Disconnect black wire from the DC cord (5), and the bus bar (3) from the ammeter (Figure 14-22, Page 14-24).
- 3. Remove the two nuts (2) that secure the ammeter to the charger face (Figure 14-22, Page 14-24).
- 4. Remove the ammeter from the face of the charger.

Ammeter Installation

- 1. Place the ammeter in position in the charger face (Figure 14-22, Page 14-24).
- 2. Install nuts (2) and tighten until ammeter is firmly secured (Figure 14-22, Page 14-24).
- 3. Connect the black wire of the DC cord (5) to the left (as viewed from inside the charger) post of the ammeter (Figure 14-22, Page 14-24).
- 4. Connect the bus bar (3) from the fuse link to the right post of the ammeter. Place flat washers on both sides of the bus bar (Figure 14-22, Page 14-24).
- 5. Thread nuts (4) onto both posts of ammeter until just past finger tight. While holding the inside nut, tighten the outside nut (4) 1/4 turn (Figure 14-22, Page 14-24). See following CAUTION.

A CAUTION

- DO NOT ALLOW AMMETER POST TO ROTATE AS THE NUT (4) IS TIGHTENED. IF IT IS ALLOWED TO ROTATE, THE AMMETER COULD BE DAMAGED (FIGURE 14-22, PAGE 14-24).
- 6. Replace the charger cover.
- 7. Plug the charger into the vehicle and check ammeter for proper operation.

14 POWERDRIVE BATTERY CHARGER Charger Repairs

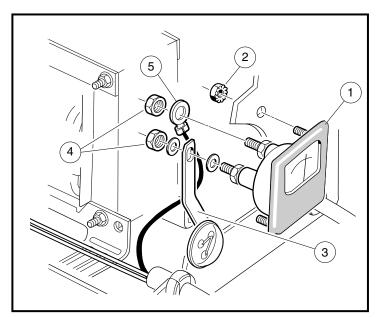


Figure 14-22 Ammeter Replacement

FUSE LINK

Read DANGER and WARNING on page 14-1.

Fuse Link Removal

- 1. Disconnect the AC and DC cords and remove the charger cover.
- 2. Remove both black secondary transformer leads and the bus bar from the back of the fuse link assembly (Figure 14-22, Page 14-24).
- 3. Remove screws from the front of the charger and remove the fuse link assembly.

Fuse Link Installation

- Place clear plastic cover over fuse assembly and install mounting screws from front of charger face.
 The center branch of the fuse assembly should be in the upper left corner when viewed from the front
 of the charger.
- 2. Install the bus bar over the center branch of the fuse assembly and ammeter post (Figure 14-22, Page 14-24). Tighten to 27 in-lb (3.0 N-m).
- 3. Install a secondary transformer lead (black) onto one of the two remaining terminals on the back of the fuse assembly. Install the remaining secondary transformer lead (black) onto the remaining terminal (Figure 14-22, Page 14-24). Tighten to 27 in-lb (3.0 N-m).
- 4. Replace charger cover.

VOLTAGE SUPPRESSOR (STATIONARY CHARGER ONLY) Read DANGER and WARNING on page 14-1.

The voltage suppressor protects the onboard computer by capturing very high, but very brief voltage spikes which occur due to the collapse of the electrical field in the charger relay when the charger is disconnected from the vehicle. See also Test Procedure 8–Continuity, Voltage Suppressor, Page 14-20.

Voltage Suppressor Removal

1. Disconnect the AC and DC cords and remove the charger cover.

- 2. Remove nut attaching voltage suppressor (18 gauge red wire) to heatsink (Figure 14-23, Page 14-26).
- 3. Disconnect blue wire to DC cord at quick disconnect terminal (Figure 14-23, Page 14-26).
- 4. Disconnect voltage suppressor from charger relay (Figure 14-23, Page 14-26).

Voltage Suppressor Installation

1. Install in reverse order of removal. Tighten nut attaching voltage suppressor (18 gauge red wire) to heatsink to 18 in-lb (2.0 N-m).

NOTE

• THE CHARGER RELAY BLADE CONNECTOR IS LOCATED OFF-CENTER WITHIN THE RELAY HOUSING. WHEN CONNECTING VOLTAGE SUPPRESSOR SLIP-ON CONNECTOR TO RELAY BLADE CONNECTOR, MAKE SURE SLIP-ON CONNECTOR IS POSITIONED SO THAT FLAT SIDE OF CONNECTOR IS CLOSEST TO RELAY HOUSING. SEE FIGURE 14-23.

CHARGER RELAY

Read DANGER and WARNING on page 14-1.

Charger Relay Removal

- 1. Disconnect the AC and DC cords and remove the charger cover.
- 2. Disconnect the red, blue, black, and primary coil wires from the relay (Figure 14-23, Page 14-26).
- 3. Remove two nuts and lock washers attaching relay to the charger base (Figure 14-23, Page 14-26).
- 4. Remove the relay.

Charger Relay Installation

1. Install in reverse order of removal. Connect wires as shown (Figure 14-23, Page 14-26). Tighten nut connecting relay to charger base to 18 in-lb (2.0 N-m).

CHARGER AC CIRCUIT BREAKER

Read DANGER and WARNING on page 14-1.

AC Circuit Breaker Removal

- 1. Disconnect the AC and DC cords and remove the charger cover.
- 2. Disconnect the two black wires attached to the AC circuit breaker (Figure 14-23, Page 14-26).
- 3. With a pair of pliers, squeeze in the retaining tabs on the sides of the AC circuit breaker and remove the circuit breaker through its mounting hole in the face of the charger (Figure 14-23, Page 14-26).

AC Circuit Breaker Installation

1. Install in reverse order of removal.

CHARGER AC CORD

Read DANGER and WARNING on page 14-1.

AC Cord Removal

- 1. Disconnect the AC and DC cords and remove the charger cover.
- Disconnect the AC cord black wire at the AC circuit breaker (Figure 14-23, Page 14-26).
- 3. Disconnect the AC cord white wire at the primary coil tan wire (Figure 14-23, Page 14-26).
- 4. Disconnect the AC cord green wire at the charger base (Figure 14-23, Page 14-26).
- 5. Use a pair of pliers to grip the strain relief bushing and remove it and the AC cord from the charger.

AC Cord Installation

- 1. Insert the black, white, and green leads of the new AC cord into the charger through the hole in the charger face (Figure 14-23, Page 14-26).
- Connect the black wire to the AC circuit breaker, the white wire to the primary coil, and the green wire to the charger base. Tighten the screw on the green (ground) wire terminal to 18 in-lb (2 N-m) (Figure 14-23, Page 14-26).
- 3. Position the strain relief bushing on the AC cord.
- 4. Using pliers, install the strain relief bushing and AC cord into the mounting hole in the charger face.
- 5. Install the charger cover.
- 6. Onboard Charger Only: Install the AC cord and reel assembly.

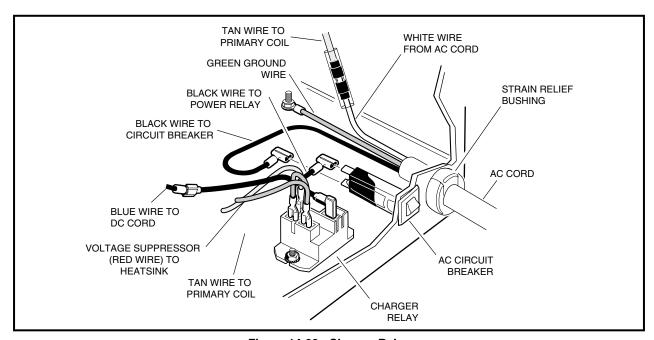


Figure 14-23 Charger Relay

CHARGING A BATTERY PACK THAT HAS LOW VOLTAGE

Read DANGER and WARNING on page 14-1.

For onboard chargers, see Bypassing the Relay on page 14-29. For stationary chargers, proceed to step 1.

- 1. Turn key switch OFF and place the Forward/Reverse handle in NEUTRAL. Leave the batteries connected.
- 2. If battery pack voltage is below 34 volts, the charger will not activate. The charger relay will have to be by-passed in order for the charger to activate.
- 3. Disconnect the DC cord from the charger receptacle and unplug the AC cord from the electrical outlet.
- 4. Remove the eight screws securing the charger cover and remove the cover from the charger.
- 5. Inside the charger, locate the black wire (3) that goes from the AC circuit breaker to the relay and disconnect it from the AC circuit breaker terminal. Make sure this wire does not touch the charger housing or any other charger component (Figure 14-24, Page 14-27).
- 6. Disconnect the transformer wire (4) from the relay and then connect this wire to the open terminal on the AC circuit breaker (Figure 14-24, Page 14-27).
- 7. Plug the DC cord into the charger receptacle first, and then plug the AC cord into an electrical outlet.

8. The charger should activate and begin to charge the batteries. Allow the charger to operate for one or two hours. **See following WARNING**.

WARNING

 DO NOT LEAVE THE VEHICLE UNATTENDED WHILE IT IS CHARGING. THE CHARGER OPERATING WITH A BYPASSED RELAY COULD SHORT CIRCUIT AND POSSIBLY CAUSE A FIRE.

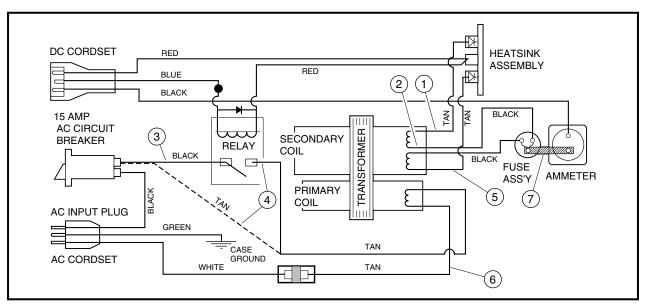


Figure 14-24 PowerDrive Charger Wiring Diagram (Relay Bypass)

- 9. After one or two hours, disconnect the charger AC cord from the electrical outlet *first*. Then disconnect the DC cord from the charger receptacle in the vehicle.
- 10. Disconnect transformer wire from AC circuit breaker and connect it to the relay. Reconnect the short black wire from the relay to the AC circuit breaker (Figure 14-24, Page 14-27).
- 11. Install the charger cover and the eight retaining screws.
- 12. Plug the DC cord into the charger receptacle and plug the AC cord into an electrical outlet.
- 13. Allow the charger to continue charging the batteries until the charger shuts of automatically.
- 14. When the charge cycle is complete, test the batteries again. If the battery pack voltage is above 34 volts and the vehicle will not operate, it will be necessary to troubleshoot the vehicle's electrical system to determine which electrical component has failed. See Section 11–Electrical System and Testing.

ONBOARD CHARGER

Read DANGER and WARNING on page 14-1.

Onboard Charger Removal

- 1. Disconnect batteries as shown (Figure 14-4, Page 14-4).
- 2. Remove four bolts (21), flatwashers (22), lockwashers (23) and nuts (24) from charger mounting brackets (Figure 14-28, Page 14-29).
- 3. Remove black plastic component cover from the electrical component mounting plate.
- 4. Remove 10 gauge black charger DC cord wire (12) from the terminal strip (Figure 14-26, Page 14-28).
- 5. Remove 10 gauge red charger DC cord wire (23) from large post of solenoid (Figure 14-27, Page 14-28).

14 POWERDRIVE BATTERY CHARGER Onboard Charger

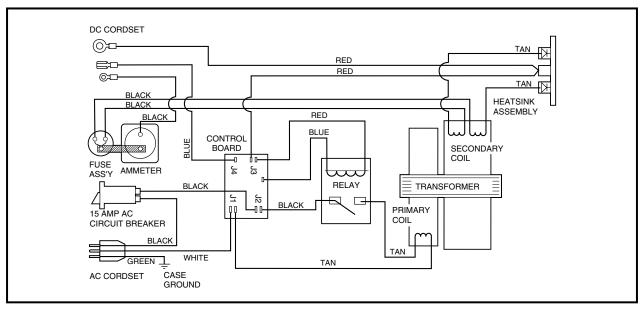


Figure 14-25 Onboard PowerDrive Charger Wiring Diagram

- 6. Cut wire tie that secures DC cord to wiring harness.
- 7. Remove four screws from the AC cord bezel and remove cord from bezel.
- 8. Lift charger and reel assembly from vehicle.

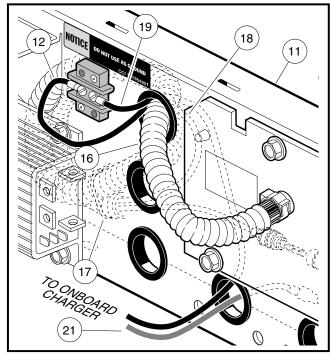


Figure 14-26 Disconnect Black Charger DC Cord

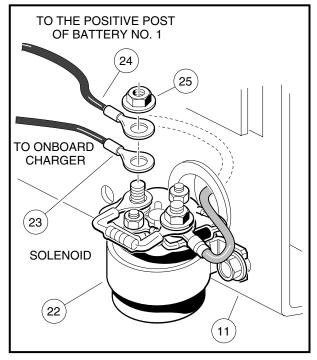


Figure 14-27 Disconnect Red Charger DC Cord

Onboard Charger Installation

1. Installation is reverse of removal. Tighten four screws connecting AC cord bezel to frame to 12 in-lb (2.5 N-m). Reconnect battery wires. Tighten to 110 in-lb (12.4 N-m).

TROUBLESHOOTING THE ONBOARD CHARGER Read DANGER and WARNING on page 14-1.

NOTE

• UNLESS OTHERWISE STATED, THE TROUBLESHOOTING PROCEDURES FOR THE ONBOARD CHARGER ARE THE SAME AS FOR THE STANDARD 48 VOLT CHARGER (SEE PAGES 14-9 THROUGH 14-12).

BYPASSING THE RELAY

- 1. Disconnect AC power cord and remove the charger cover.
- 2. Disconnect black 10 gauge wire at the AC circuit breaker (Figure 14-31, Page 14-30).
- 3. Disconnect tan transformer primary coil wire from relay (Figure 14-31, Page 14-30).
- 4. Connect tan transformer wire to open terminal on the AC circuit breaker (Figure 14-31, Page 14-30).
- 5. Connect AC plug to outlet.

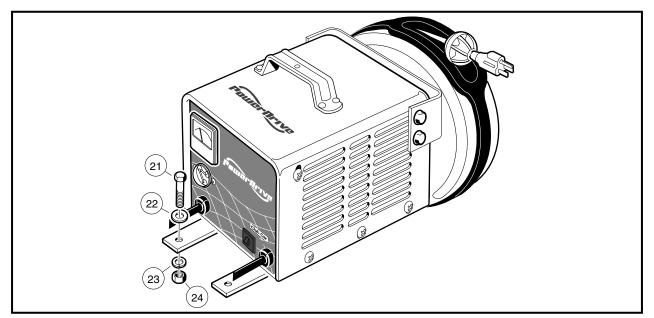


Figure 14-28 Onboard Charger with Reel

TESTING THE CONTROL BOARD

DC Circuit Test

Disconnect AC cord from outlet. DC cord red, black and blue wires remain connected to the vehicle. All wires remain connected to the control board. Set multimeter to 200 volts DC.

- 1. Place black (-) probe of multimeter on terminal with blue DC cord wire and red (+) probe to terminal with red relay wire (Figure 14-29, Page 14-30).
- 2. Multimeter should indicate full battery voltage (approximately 47-50 volts). If reading is incorrect, replace control board.

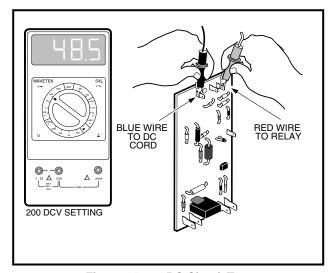
AC Circuit Test

Disconnect AC cord from outlet. DC cord red, black and blue wires remain connected to vehicle. Set multimeter to volts AC.

1. Disconnect tan wire from transformer primary coil at terminal on control board (Figure 14-32, Page 14-31).

DANGER

- HIGH VOLTAGE APPROXIMATELY 110-125 AC! USE EXTREME CAUTION WHEN PERFORMING AC CIRCUIT TESTS.
- PHYSICAL CONTACT WITH AC TERMINALS ON CONTROL BOARD COULD RESULT IN ELECTRICAL SHOCK OR DEATH.
- DO NOT ALLOW TERMINAL END ON TAN TRANSFORMER PRIMARY COIL TO TOUCH OTHER WIRES OR COMPONENTS IN THE CHARGER.
- Place black (-) probe of multimeter, set to 200 volts AC, onto terminal with black AC circuit breaker wire. Connect red (+) probe to terminal from which tan transformer wire was disconnected (Figure 14-30, Page 14-30).
- 3. Connect AC cord to outlet. Reading should be approximately 110 to 125 volts AC.
- 4. If reading is incorrect, replace control board.



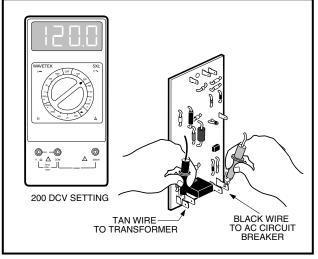


Figure 14-29 DC Circuit Test

Figure 14-30 AC Circuit Test

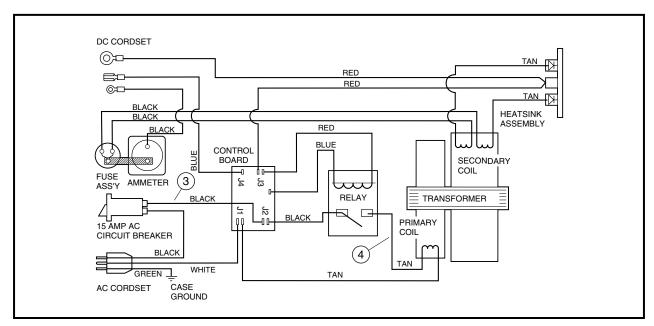


Figure 14-31 Onboard Charger Wiring Diagram (Relay Bypass)

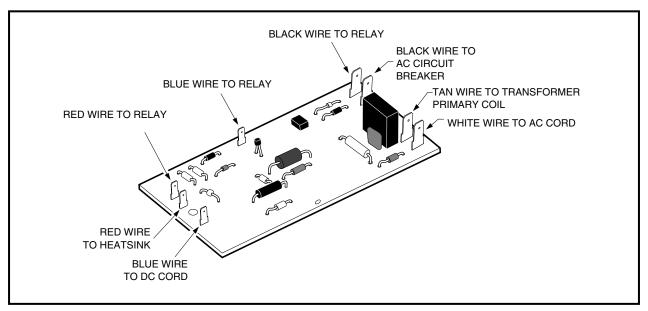


Figure 14-32 Control Board

A DANGER

- BATTERY EXPLOSIVE GASES! DO NOT SMOKE. KEEP SPARKS AND FLAMES AWAY. VENTILATE WHEN CHARGING OR USING IN AN ENCLOSED SPACE. ALWAYS WEAR FULL FACE SHIELD AND RUBBER GLOVES WHEN WORKING ON OR NEAR BATTERIES.
- USE EXTREME CAUTION WHEN USING TOOLS, WIRES, OR METAL OBJECTS NEAR BATTERIES! A SHORT CIRCUIT AND (OR) SPARK COULD CAUSE AN EXPLOSION.
- BATTERY POISON! CONTAINS ACID! CAUSES SEVERE BURNS. AVOID CONTACT WITH SKIN, EYES, OR CLOTHING. ANTIDOTES:
 - EXTERNAL: FLUSH WITH WATER. CALL A PHYSICIAN IMMEDIATELY.
 - INTERNAL: DRINK LARGE QUANTITIES OF MILK OR WATER. FOLLOW WITH MILK OF MAGNESIA OR VEGETABLE OIL. CALL A PHYSICIAN IMMEDIATELY.
 - EYES: FLUSH WITH WATER FOR FIFTEEN MINUTES. CALL PHYSICIAN IMMEDIATELY.

A WARNING

- ONLY TRAINED TECHNICIANS SHOULD REPAIR OR SERVICE THIS VEHICLE. ANYONE DOING EVEN SIMPLE REPAIRS OR SERVICE SHOULD HAVE KNOWLEDGE AND EXPERIENCE IN ELECTRICAL AND MECHANICAL REPAIR.
- FOLLOW ALL PROCEDURES EXACTLY AS STATED IN THIS MANUAL, AND HEED ALL DANGER, WARNING AND CAUTION STATEMENTS, AS WELL AS THOSE AFFIXED TO THE VEHICLE.
- WEAR SAFETY GLASSES OR APPROVED EYE PROTECTION WHILE SERVICING VEHICLE.
- TURN KEY SWITCH OFF, PLACE FORWARD/REVERSE HANDLE IN THE NEUTRAL POSITION. AND REMOVE KEY BEFORE SERVICING THE VEHICLE.
- MOVING PARTS! DO NOT ATTEMPT TO SERVICE THE VEHICLE WHILE IT IS RUNNING.
- USE INSULATED TOOLS WHEN WORKING NEAR BATTERIES OR ELECTRICAL CONNECTIONS. USE EXTREME CAUTION TO AVOID SHORTING OF COMPONENTS OR WIRING.
- LIFT ONLY ONE END OF THE VEHICLE AT A TIME. BEFORE LIFTING, LOCK THE BRAKES AND CHOCK THE WHEELS THAT REMAIN ON THE FLOOR. USE A SUITABLE LIFTING DEVICE (CHAIN HOIST OR HYDRAULIC FLOOR JACK) WITH 1000 LB. (454 KG.) MINIMUM LIFTING CAPACITY. DO NOT USE LIFTING DEVICE TO HOLD VEHICLE IN RAISED POSITION. ALWAYS USE APPROVED JACKSTANDS OF PROPER WEIGHT CAPACITY TO SUPPORT THE VEHICLE.
- TO AVOID UNINTENTIONALLY STARTING VEHICLE, DISCONNECT BATTERIES AS SHOWN IN FIGURE 15-1, PAGE 15-2. AND DISCHARGE THE CONTROLLER AS FOLLOWS:
 - TURN THE KEY SWITCH TO ON AND PLACE THE FORWARD/REVERSE HANDLE IN THE **REVERSE POSITION.**
 - SLOWLY DEPRESS THE ACCELERATOR PEDAL AND KEEP IT DEPRESSED UNTIL THE REVERSE WARNING BUZZER CAN NO LONGER BE HEARD. WHEN THE BUZZER STOPS SOUNDING, THE CONTROLLER IS DISCHARGED.

GENERAL INFORMATION

All PowerDrive electric vehicles are equipped with PowerDrive System 48 electrical systems which utilize 48 volt DC, series wound, reversible traction motors. If the motor should require major repair, it should be sent to a qualified motor repair shop. There are, however, many minor repairs that can be made by a trained technician.

15 MOTOR External Motor Testing

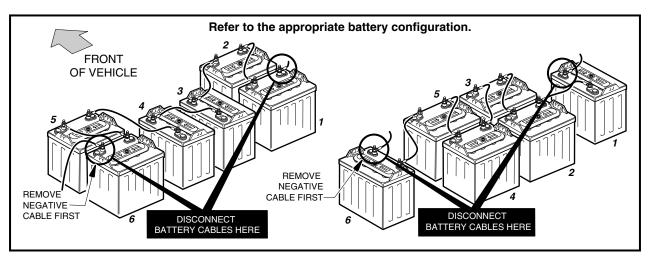


Figure 15-1 PowerDrive Battery Configuration

EXTERNAL MOTOR TESTING

Using a multimeter or continuity tester, the following tests can be performed without disassembling the motor.

NOTE

TAG THE MOTOR WIRES FOR IDENTIFICATION BEFORE DISCONNECTING.

Test Procedure 1 - Internal Short Circuits

Read DANGER and WARNING on page 15-1.

- 1. Disconnect batteries as shown (Figure 15-1, Page 15-2) and discharge the controller as instructed in WARNING on page 15-1.
- 2. Using two wrenches to prevent the posts from turning, disconnect wires from terminals on motor.
- 3. Using a multimeter set to 200 Ω (ohms), place the black (–) probe on the motor housing. Scratch through the paint to ensure a good connection. Place the red (+) probe on the A1, A2, S1, and S2 terminals respectively (Figure 15-2, Page 15-2). Multimeter should indicate no continuity. If the readings are incorrect, the motor will need to be removed from the vehicle and repaired by a qualified technician. See Motor Removal, Page 15-3.

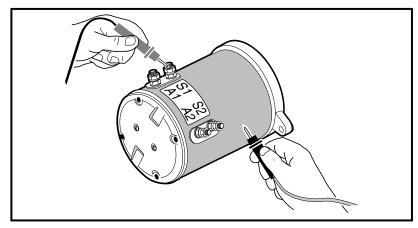


Figure 15-2 Test for Motor Short Circuits

Motor

3.1. An incorrect reading from A1 or A2 terminal indicates three possible problems: a grounded A1 or A2 terminal, a grounded wire in the brush area, or a grounded armature/commutator. If the S1 or S2 reading is incorrect, it could be due to a grounded S1 or S2 terminal or a grounded field coil.

Test Procedure 2 - Armature Circuit Open

Read DANGER and WARNING on page 15-1.

- 1. Disconnect the batteries as shown (Figure 15-1, Page 15-2) and discharge the controller as instructed in the WARNING on page 15-1.
- 2. Using two wrenches to prevent the post from turning, disconnect the wires from the A1 and A2 terminals. Using a multimeter set to 200 Ω (ohms), place the red (+) probe on the A1 terminal and the black (-) probe on the A2 terminal (Figure 15-2, Page 15-2). The multimeter should indicate continuity. If the reading is incorrect, a possible open or poor contact in a brush assembly and/or open armature windings may be the cause. The motor will need to be removed from the vehicle and repaired by a qualified technician. See Motor Removal.

Test Procedure 3 - Field Circuit Open

Read DANGER and WARNING on page 15-1.

- 1. Disconnect the batteries as shown (Figure 15-1, Page 15-2) and discharge the controller as instructed in the WARNING on page 15-1.
- 2. Using two wrenches to prevent the post from turning, disconnect the wires from the S1 and S2 terminals. Using a multimeter set to 200 Ω (ohms), place the red (+) probe on the S1 terminal and the black (-) probe on the S2 terminal (Figure 15-2, Page 15-2). The reading should be continuity. If the reading is incorrect, there may be an open field coil or bad connections at terminals. Remove motor from vehicle and send to a qualified technician for repair. See Motor Removal.

MOTOR

Read DANGER and WARNING on page 15-1.

Motor Removal

- 1. Disconnect the battery cables, as shown (Figure 15-1, Page 15-2) and discharge the controller as instructed in the WARNING on page 15-1.
- 2. Using two wrenches to prevent the post from turning, disconnect wires from terminals on motor. Label the wires to ensure proper reconnection.

For DS, and all Villager vehicles, follow steps 3-8. For all other vehicles proceed to step 9:

- 3. Slightly loosen all the lug nuts on both rear wheels.
- 4. Place floor jack under transaxle and raise rear of vehicle (Figure 15-3, Page 15-4) then place jackstands under frame cross-member between spring mount and side stringer, just forward of each rear wheel. Lower the vehicle to let the jackstands support the vehicle (Figure 15-4, Page 15-4). See following WARNING.

A WARNING

- LIFT ONLY ONE END OF THE VEHICLE AT A TIME. BEFORE LIFTING, LOCK THE BRAKES AND CHOCK THE WHEELS THAT REMAIN ON THE FLOOR. USE A SUITABLE LIFTING DEVICE (CHAIN HOIST OR HYDRAULIC FLOOR JACK) WITH 1000 LB. (454 KG.) MINIMUM LIFTING CAPACITY. DO NOT USE LIFTING DEVICE TO HOLD VEHICLE IN RAISED POSITION. ALWAYS USE APPROVED JACKSTANDS OF PROPER WEIGHT CAPACITY TO SUPPORT THE VEHICLE.
- 5. Remove both rear wheels.

Motor Motor

Motor Removal, Continued:

6. Remove the nut, cup washer, and bushing from the bottom side of the shock absorber. Compress the shock absorber (pushing upwards) to move it out of the way.

- 7. Remove the nuts and bolts mounting the rear leaf springs to the shackles (Figure 15-5, Page 15-4).
- 8. To gain easier access to the motor, lower the transaxle as low as it will go. If more room is needed, remove the jack from beneath the transaxle and allow the springs to rest on the floor (Figure 15-5, Page 15-4).
- 9. Remove the four bolts that mount the motor to the transaxle.

A CAUTION

- DO NOT PLACE FINGERS OR HANDS UNDER MOTOR DURING REMOVAL. SEVERE INJURY COULD RESULT IF FINGERS OR HANDS ARE CAUGHT BETWEEN MOTOR AND AXLE TUBE.
- 10. Carefully slide the motor away from the transaxle until the motor spline disengages the input shaft. Remove the motor from the vehicle.

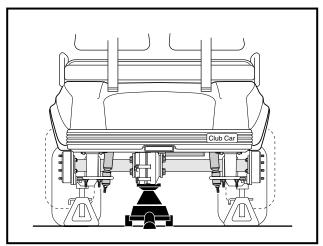


Figure 15-3 Lift Vehicle with Floor Jack

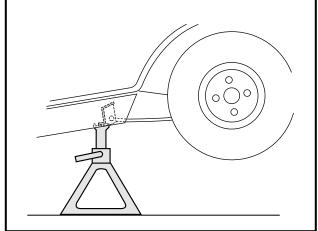


Figure 15-4 Support Vehicle on Jackstands

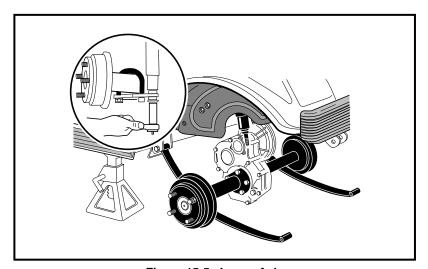
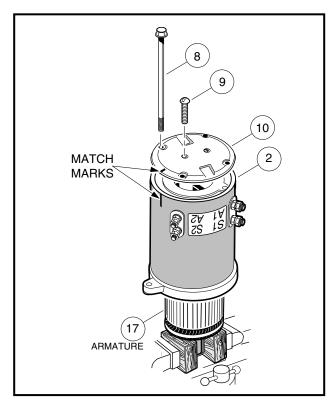


Figure 15-5 Lower Axle

Motor Disassembly

- 1. Before beginning disassembly, match mark motor end shield and stator shell. Place motor in a vice with wooden blocks as shown (Figure 15-6, Page 15-5). Read DANGER and WARNING on page 15-1.
- 2. Remove the four bolts (8) securing the end shield (10) to the stator shell (2) (Figure 15-6, Page 15-5).
- 3. Remove the two screws (9) attaching the end shield to the bearing retainer (Figure 15-6, Page 15-5).
- 4. Slide the armature (17) out of the opposite end of the stator shell (2) (Figure 15-6, Page 15-5).



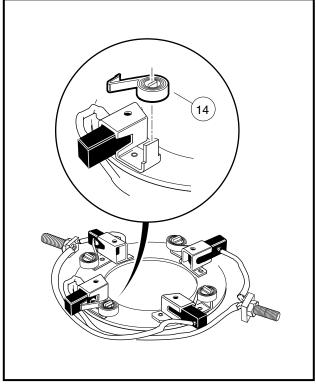


Figure 15-6 Motor Disassembly

Figure 15-7 Brush Spring Removal

- 5. Remove the two screws (11) attaching the brush rigging (12) to the stator shell (Figure 15-12, Page 15-10).
- 6. Mark the brush terminal posts (A1 and A2) (27, 28) to identify their positions in the stator shell. Remove the nuts (6) and flat washers (5) (Figure 15-12, Page 15-10). From the outside, push the posts through the stator shell wall and into the interior of the stator shell.
- 7. Carefully remove the brush rigging and the terminal posts from the stator shell.
- 8. To remove brush springs (14) from rigging, lift spring extensions out of and over the brush mounts and then slide the springs off their mounting tabs (Figure 15-7, Page 15-5).

TESTING AND INSPECTING INDIVIDUAL COMPONENTS

Read DANGER and WARNING on page 15-1.

ARMATURE

- 1. Disassemble the motor and carefully inspect the armature. Look for these characteristics:
- Burned, charred or cracked insulation.
- · Improperly cured varnish.
- · Thrown solder.

Armature, Continued:

- Flared armature windings.
- Damaged armature core laminations.
- Worn, burned or glazed commutators.
- · Dirty or oily commutators.
- · Raised commutator bars.
- Worn armature bearing or shaft.

A dirty or oily commutator should be cleaned and wiped dry. Abnormalities identified during the inspection can help determine original cause of failure. Slight roughness of the commutator can be polished smooth with 400 grit or finer sandpaper. See following CAUTION and NOTE.

CAUTION

 NEVER USE EMERY CLOTH TO POLISH THE COMMUTATOR. PARTICLES OF EMERY ARE CONDUCTIVE AND MAY SHORT-CIRCUIT THE COMMUTATOR BARS. NEVER USE OIL OR LUBRICANTS ON THE COMMUTATOR OR BRUSHES.

NOTE

OIL ON THE COMMUTATOR MAY INDICATE A FAULTY TRANSAXLE INPUT SHAFT OIL SEAL.

Armature Ground Test

A CAUTION

• DO NOT SUBMERGE THE ARMATURE IN SOLVENT.

NOTE

 BEFORE TESTING THE ARMATURE. WIPE IT CLEAN WITH A CLEAN CLOTH, REMOVE ANY CARBON DUST AND METAL PARTICLES FROM BETWEEN THE COMMUTATOR BARS.

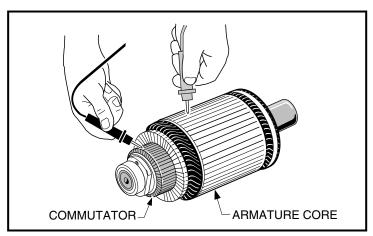


Figure 15-8 Armature

1. With multimeter set to 200 Ω (ohms), place one probe on commutator and the other on the armature core. The tester should indicate no continuity (Figure 15-8, Page 15-6). If reading is incorrect, replace the motor.

FIELD WINDINGS INSPECTION

Burned or scorched insulation on the field windings indicates the motor has overheated due to overloads or due to grounded or shorted coil windings. If the insulation on the windings is scorched, replace the motor or the stator shell assembly.

MOTOR COMPONENTS

- 1. Inspect the insulators (4 and 7) for cracks or other damage (Figure 15-12, Page 15-10).
- 2. Inspect brushes (13) for damage or excessive wear (Figure 15-12, Page 15-10). If brushes need to be replaced, see following NOTE.
- 3. Inspect brush springs (14) (Figure 15-12, Page 15-10). Replace discolored springs (light gold or blue tinted). Replace springs which apply a force of less than 16 oz. (Figure 15-10, Page 15-8).

CAUTION

 WHEN CHECKING BRUSH SPRING TENSION, DO NOT OVER-EXTEND THE SPRING. USING EXCESSIVE FORCE WILL DAMAGE THE SPRING.

NOTE

- WHEN INSTALLING NEW BRUSHES, REMOVE AND REPLACE BRUSHES ONE AT A TIME, THIS METHOD ENSURES THE TERMINALS AND BRUSHES WILL BE PROPERLY POSITIONED IN THE RIGGING. SEE PAGE 15-9 FOR BRUSH INSTALLATION.
- ALWAYS REPLACE ALL FOUR BRUSHES, NEVER REPLACE ONLY TWO.
- INSTALL THE BRUSHES IN THE SAME RIGGING 180° FROM EACH OTHER.

BEARING INSPECTION

- 1. Using a clean cloth, wipe the carbon dust off the bearing. Inspect the bearing by spinning it by hand and checking for both axial (A) and radial (B) play (Figure 15-11, Page 15-8).
- 2. Replace the bearing if it is noisy, does not spin smoothly, or has excessive play. Check the bearing and replace if rusted, worn, cracked, or if there is an abnormal color change in the metal of the bearing. Do not remove the bearing from the armature shaft unless it is to be replaced.

BEARING REMOVAL

1. Place the wedge attachment tool (Club Car Part No. 1012812) between the bearing (15) and the armature (17) (Figure 15-12, Page 15-10). Make sure the wedge attachment tool is supporting the inner race of the bearing. If a press is not available, secure a bearing puller (Club Car Part No. 1012811) to the bearing and pull the bearing off the end of the armature shaft. Support the shaft so it will not drop when the bearing is removed (Figure 15-9, Page 15-8). Discard the bearing.

BEARING INSTALLATION

1. Press a new bearing (15) onto the armature. Use an arbor press that exerts pressure on the inner race only (Figure 15-12, Page 15-10). See following NOTE.

NOTE

- MAKE SURE THE BEARING RETAINER (16) (FIGURE 15-12, PAGE 15-10) IS POSITIONED ON THE ARMATURE SHAFT BEFORE THE BEARING IS PRESSED ONTO THE ARMATURE.
- USE AN ARBOR WITH AN OUTSIDE DIAMETER OF LESS THAN 5/8 INCH (16 MM) TO PRESS THE BEARING ONTO THE ARMATURE.

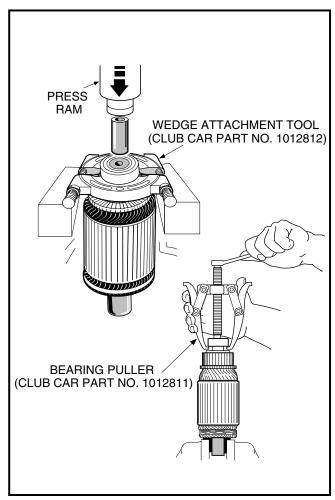


Figure 15-9 Bearing Removal

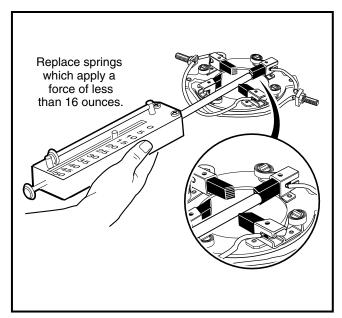


Figure 15-10 Check Brush Spring Tension

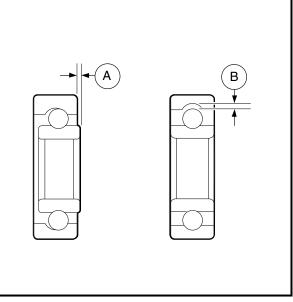


Figure 15-11 Inspect Bearing

RECONDITIONING THE MOTOR

Read DANGER and WARNING on page 15-1.

Motor reconditioning must be performed by a qualified motor repair technician. The use of proper tools and procedures is absolutely essential for successful motor reconditioning.

Motor Specifications

Any rework must be performed by a qualified technician. Motor service specifications are listed in the table below.

ITEM	SERVICE LIMIT
Commutator diameter (minimum)	2.265 inch (66.675 mm)
Commutator concentric with armature shaft within	.001 inch (0.0508 mm)
Limit depth of cut when machining commutator	.005 inch (0.127 mm)
Bar to bar run out should not exceed	.0002 inch (.00508 mm)
If undercut of segment insulator is less than .016 inch (0.406 mm), it should be undercut to	.031 inch (0.8 mm)
Machined face of Commutator	8-16 micro inches
Field coil resistance (PowerDrive System 48, 3.10 Hp.)	0.02040 Ω (ohms)

MOTOR ASSEMBLY

Read DANGER and WARNING on page 15-1.

- 1. If the bearing has been removed, replace the bearing:
 - 1.1. Press a new bearing (15) onto the armature. Use an arbor press that exerts pressure on the inner race only (Figure 15-12, Page 15-10). See NOTE following Bearing Installation on page 15-7.
- 2. Install the brushes. See NOTE on page 15-7.
 - 2.1. With brush rigging facing down and held slightly above the stator shell, insert the two terminal posts through the insulators in the stator shell wall at the A1 and A2 positions. Insert the brush holder screws through the rubber sealed holes in the rigging and into the threaded holes in the mounting bracket (Figure 15-13, Page 15-11). Tighten the screws to 20 in-lb (2.2 N-m).
 - 2.2. One at a time, push brush spring extensions back from brushes and slide the brushes back until they are completely retracted into their mounting slots. Then position the brush springs against the sides of the brushes so that spring pressure will hold them in the retracted position (Figure 15-7, Page 15-5).
 - 2.3. Slide the armature, bearing end first, into the stator shell. Make sure the brushes are held back while positioning the armature for proper commutator/brush contact. Release the brushes and place the springs outside the brushes so the brushes are being held against the commutator. See following CAUTION.

A CAUTION

 IF THE MOTOR IS BEING ASSEMBLED WITH THE ARMATURE STANDING ON END AS THE COMMUTATOR IS POSITIONED, MAKE SURE THE BRUSHES ARE HELD BACK. DO NOT ALLOW THE BRUSHES TO SUPPORT THE WEIGHT OF THE STATOR SHELL. THE BRUSHES CAN BE EASILY DAMAGED BY THIS WEIGHT.

5 MOTOR Motor Assembly

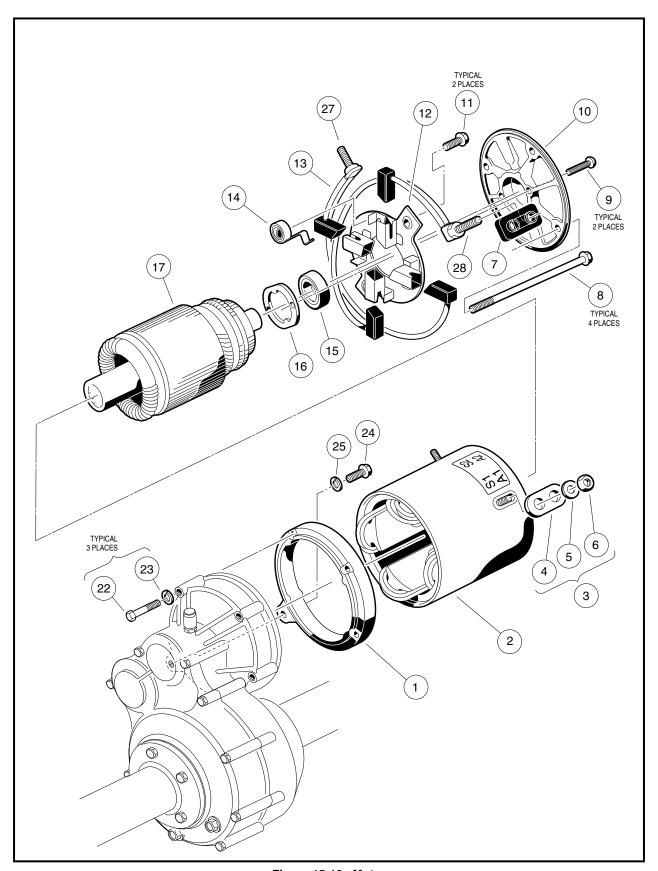
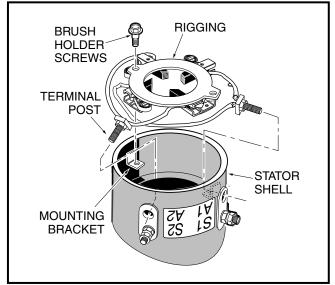


Figure 15-12 Motor

Page 15-10 2000 PowerDrive System 48 Vehicle Maintenance and Service Supplement



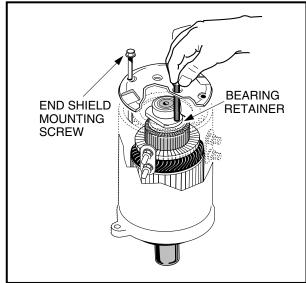


Figure 15-13 Brush Installation

Figure 15-14 End Shield Installation

- Install end shield onto the stator shell.
 - 3.1. Attach end shield (10) to bearing retainer (16). Align holes in bearing retainer with the two holes in end shield and install screws (9) (Figure 15-12, Page 15-10). Tighten screws to 17 in-lb (1.9 N-m).

NOTE

- USE A LONG SCREW WITH THE SAME THREAD SPECIFICATIONS AS THE MOUNTING SCREWS TO MAINTAIN HOLE ALIGNMENT WHILE STARTING THE FIRST MOUNTING SCREW. SEE FIGURE 15-14. PAGE 15-11.
 - 3.2. Align the match marks on the end shield and the stator shell. Install the four screws (8) (Figure **15-12, Page 15-10)**. Tighten the screws to 90 in-lb (10 N-m).
- 4. Make sure the armature turns freely. If it does not turn freely, disassemble the motor to find the problem. Make sure the bearing is properly seated in the end shield when assembling the motor.

MOTOR INSTALLATION

Read DANGER and WARNING on page 15-1.

- 1. Thoroughly clean any existing grease from the motor coupling spline and the transaxle input shaft using CRC® Brakleen™ spray cleaner only.
- 2. Using a 1/4 inch wide flat-blade screwdriver, apply Nyogel PG-44A Damping Grease (Club Car part No. 102185301) to the transaxle input shaft splines, coating an area 1/4 to 3/8 inches wide from the tip end of the shaft. Be certain to fill all of the spline grooves within that area. Do not apply too much grease as this may cause difficulty when installing the motor.
- 3. Install the motor on the transaxle shaft, sliding it back and forth several times to distribute the lubricant.
- 4. Rotate the motor until the locating bolt mounting hole on the motor is aligned with its mounting hole in the transaxle case. Install the bolt (24) with lock washer (25). Do not tighten at this time (Figure 15-12, Page 15-10). See also Figure 15-15, Page 15-12.

5 MOTOR Motor Installation

Motor Installation, Continued:

5. Install, but do not tighten the three bolts (22) with lock washers (23) that mount the motor to the transaxle (Figure 15-12, Page 15-10). See following CAUTION.

A CAUTION

- MAKE SURE THE MOTOR IS PROPERLY SEATED ON THE TRANSAXLE HOUSING.
- 6. Finger tighten the four bolts, moving from bolt (C) to bolts (A, B, and D) until the motor is seated. With one wheel jacked up so it is off the ground, rotate the axle to make sure the motor is not binding on the transaxle input shaft (Figure 15-16, Page 15-12). See following NOTE.

NOTE

- FAILURE TO TIGHTEN THE MOTOR MOUNTING BOLTS TO THE PROPER TORQUE AND IN THE PROPER SEQUENCE CAN RESULT IN MOTOR NOISE DURING OPERATION.
- 7. Using a torque wrench, tighten the lower 1/4 inch bolt (C). Now tighten the bolt (A), then tighten the center bolt (B) at the top. Tighten these bolts to 65 in-lb (7.3 N-m). Tighten the bolt (D) to 155 in-lb (17.5 N-m) (Figure 15-16, Page 15-12).
- 8. Install the motor wires, making sure they are connected to the correct terminals. Tighten the terminal retaining nuts to 65 in-lb (7.3 N-m). **See following NOTE**.

NOTE

• IF MOTOR WIRES WERE NOT TAGGED FOR IDENTIFICATION BEFORE BEING DISCONNECTED, SEE WIRING DIAGRAM, SECTION 11, FIGURES 11-2 THROUGH 11-6, PAGES 11-3 THROUGH 11-7.

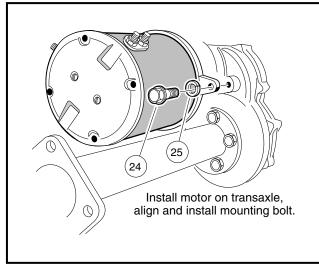


Figure 15-15 Motor Installation

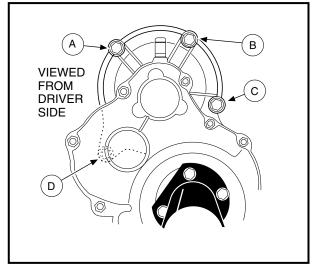


Figure 15-16 Motor Mount

For DS, and all Villager vehicles, follow steps 9-13. For all other vehicles proceed to step 14:

9. With a floorjack, lift the transaxle while, at the same time, guiding the leaf springs into the shackles. See Section 9–Rear Suspension, in the appropriate Maintenance and Service Manual.

10. Insert the mounting bolts through the spring shackles and the bushings in the leaf spring eyes and install lock nuts. Tighten the bolts to 23 ft-lb. (31 N-m). See Section 9-Rear Suspension, in the appropriate Maintenance and Service Manual.

- 11. Install the shock absorbers. See Section 9-Rear Suspension, in the appropriate Maintenance and Service Manual.
- 12. Install the wheels and finger tighten lug nuts.
- 13. Lift vehicle and remove jackstands. Lower vehicle to the floor and tighten lug nuts (using a criss-cross pattern) to 55 ft-lb (74.6 N-m).
- 14. Connect battery cables (positive cable first) and tighten to 110 in-lb (12.4 N-m). Coat terminals with Battery Protector Spray (Club Car Part No. 1014305) to minimize corrosion (Figure 15-1, Page 15-2).

SECTION 16-TRANSAXLE

A DANGER

- BATTERY EXPLOSIVE GASES! DO NOT SMOKE, KEEP SPARKS AND FLAMES AWAY. VENTILATE WHEN CHARGING OR USING IN AN ENCLOSED SPACE. ALWAYS WEAR FULL FACE SHIELD AND RUBBER GLOVES WHEN WORKING ON OR NEAR BATTERIES.
- USE EXTREME CAUTION WHEN USING TOOLS, WIRES, OR METAL OBJECTS NEAR BATTERIES! A SHORT CIRCUIT AND (OR) SPARK COULD CAUSE AN EXPLOSION.
- BATTERY POISON! CONTAINS ACID! CAUSES SEVERE BURNS. AVOID CONTACT WITH SKIN, EYES, OR CLOTHING. ANTIDOTES:
 - EXTERNAL: FLUSH WITH WATER. CALL A PHYSICIAN IMMEDIATELY.
 - INTERNAL: DRINK LARGE QUANTITIES OF MILK OR WATER. FOLLOW WITH MILK OF MAGNESIA OR VEGETABLE OIL. CALL A PHYSICIAN IMMEDIATELY.
 - EYES: FLUSH WITH WATER FOR FIFTEEN MINUTES. CALL PHYSICIAN IMMEDIATELY.

A WARNING

- ONLY TRAINED TECHNICIANS SHOULD REPAIR OR SERVICE THIS VEHICLE. ANYONE DOING EVEN SIMPLE REPAIRS OR SERVICE SHOULD HAVE KNOWLEDGE AND EXPERIENCE IN ELECTRICAL AND MECHANICAL REPAIR.
- FOLLOW ALL PROCEDURES EXACTLY AS STATED IN THIS MANUAL, AND HEED ALL DANGER, WARNING AND CAUTION STATEMENTS, AS WELL AS THOSE AFFIXED TO THE VEHICLE.
- WEAR SAFETY GLASSES OR APPROVED EYE PROTECTION WHILE SERVICING VEHICLE.
- TURN KEY SWITCH OFF. PLACE FORWARD/REVERSE HANDLE IN THE NEUTRAL POSITION. AND REMOVE KEY BEFORE SERVICING THE VEHICLE.
- MOVING PARTS! DO NOT ATTEMPT TO SERVICE THE VEHICLE WHILE IT IS RUNNING.
- USE INSULATED TOOLS WHEN WORKING NEAR BATTERIES OR ELECTRICAL CONNECTIONS. USE EXTREME CAUTION TO AVOID SHORTING OF COMPONENTS OR WIRING.
- LIFT ONLY ONE END OF THE VEHICLE AT A TIME. BEFORE LIFTING, UNLOAD THE CARGO BED, LOCK THE BRAKES AND CHOCK THE WHEELS THAT REMAIN ON THE FLOOR. USE A SUITABLE LIFTING DEVICE (CHAIN HOIST OR HYDRAULIC FLOOR JACK) WITH 1000 LB. (454 KG.) MINIMUM LIFTING CAPACITY. DO NOT USE LIFTING DEVICE TO HOLD VEHICLE IN RAISED POSITION. ALWAYS USE APPROVED JACKSTANDS OF PROPER WEIGHT CAPACITY TO SUPPORT THE VEHICLE.
- TO AVOID UNINTENTIONALLY STARTING VEHICLE, DISCONNECT BATTERIES AS SHOWN IN SECTION 11, FIGURE 11-1, PAGE 11-2 AND DISCHARGE THE CONTROLLER AS FOLLOWS:
 - TURN THE KEY SWITCH TO ON AND PLACE THE FORWARD/REVERSE HANDLE IN THE **REVERSE POSITION.**
 - SLOWLY DEPRESS THE ACCELERATOR PEDAL AND KEEP IT DEPRESSED UNTIL THE REVERSE WARNING BUZZER CAN NO LONGER BE HEARD. WHEN THE BUZZER STOPS SOUNDING, THE CONTROLLER IS DISCHARGED.

GENERAL INFORMATION

There are two types of transaxles used in the manufacture of the electric vehicle. The different transaxles are identified by the orientation of the gear case bolt heads. The Type G transaxle has gear case bolt heads oriented toward the passenger side of the vehicle. The Type K transaxle has gear case bolt heads oriented toward the driver side of the vehicle. Please note that parts used in these transaxles are not interchangeable with one another. Service and repair procedures specific to each transaxle are noted throughout this section.

TRANSAXLE

LUBRICATION

There are two plugs located on the lower half of the transaxle housing. The upper plug (as viewed when the vehicle is on a level surface), is used as a lubricant level indicator. When the vehicle is parked on a level surface, the lubricant level should be even with the bottom of the hole. The lower plug is for draining the lubricant. When draining the lubricant, the upper plug should be removed so the lubricant will drain faster. Be sure the drain plug is reinstalled before filling.

NOTE

• RECYCLE OR DISPOSE OF USED OIL OR LUBRICANT IN ACCORDANCE WITH LOCAL, STATE AND FEDERAL REGULATIONS.

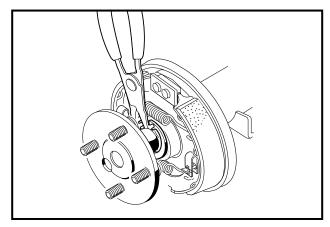
AXLE BEARING AND SHAFT

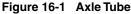
Read DANGER and WARNING on page 16-1.

AXLE SHAFT

Axle Shaft and Oil Seal Removal

- 1. Place chocks at the front wheels. Loosen lug nuts on rear wheels and lift the rear of the vehicle with a chain hoist or floor jack. Place jackstands under the axle tubes to support the vehicle.
- 2. Remove the rear wheel and brake drum. See Section 6-Wheel Brake Assemblies and Section 8-Wheels and Tires in the appropriate Maintenance and Service Manual.
- 3. Using 90° internal snap ring pliers, remove the internal retaining ring (6) from the axle tube (Figures 16-3 or 16-4, Pages 16-3 or 16-4). See also Figure 16-1, Page 16-2.
- 4. Remove the axle, retaining ring, and bearing assembly by pulling the axle straight out of the housing.





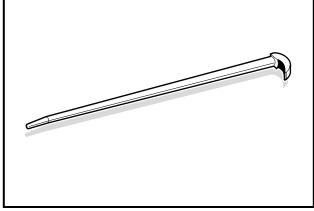


Figure 16-2 Rolling Wedge Bar

5. Use a 16 inch (40 cm) rolling wedge bar (Figure 16-2, Page 16-2) to remove oil seal. Insert wedge bar underneath the seal lip and pry out oil seal (17) (Figure 16-5, Page 16-5). See following CAUTION.

A CAUTION

- DO NOT SCAR OR DAMAGE THE INSIDE SURFACES OF THE TUBE WHEN REMOVING THE OIL SEAL. A DAMAGED TUBE MIGHT HAVE TO BE REPLACED.
- 6. Inspect the axle shaft assembly to be sure the bearing and collar have not slipped and are still seated against the shoulder on the axle shaft.

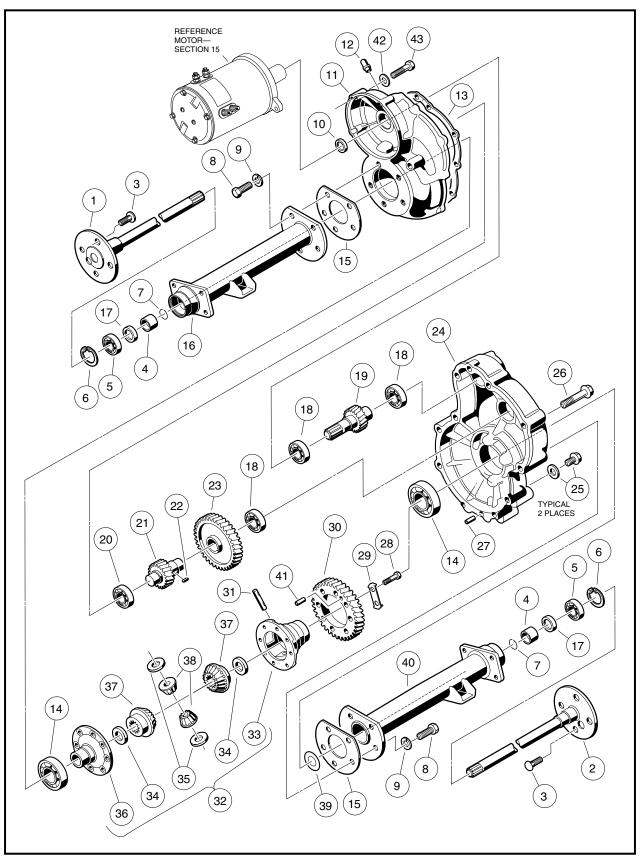


Figure 16-3 Transaxle - Type K

16 TRANSAXLE Axle Bearing and Shaft

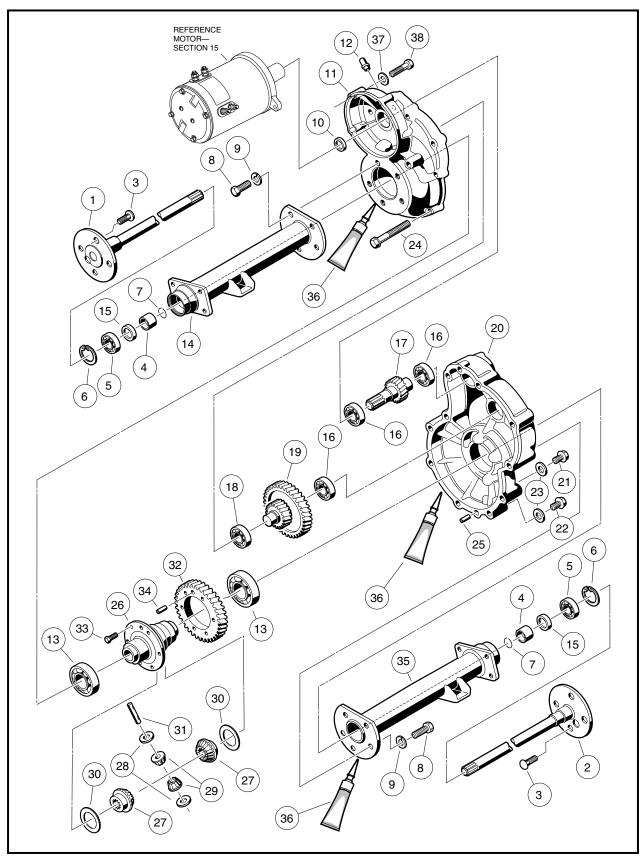


Figure 16-4 Transaxle - Type G

Axle Shaft and Oll Seal Removal Continued:

7. Inspect bearing (5) **(Figure 16-3, Page 16-3 or Figure 16-4, Page 16-4)**. If the bearing in a Type K transaxle is worn or damaged, replace bearing. If the bearing in a Type G transaxle is worn or damaged, see NOTE at Axle Bearing on Page 16-5.

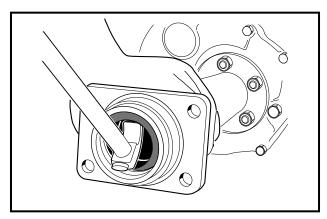


Figure 16-5 Seal Lip

AXLE BEARING

NOTE

• DO NOT REMOVE AXLE BEARING FROM A TYPE G TRANSAXLE. IF BEARING IS WORN OR DAMAGED, THE ENTIRE AXLE ASSEMBLY (1 OR 2) MUST BE REPLACED (FIGURE 16-4, PAGE 16-4).

Axle Bearing Removal (Type K Transaxle Only)

- 1. Remove the retaining ring (7) from the axle shaft (Figure 16-3, Page 16-3).
- 2. Place a bearing puller wedge attachment (Club Car Part No. 1012812) on the axle shaft between the wheel mounting flange and the bearing.
- 3. Press bearing (5) and collar (4) off together (Figure 16-6, Page 16-5).

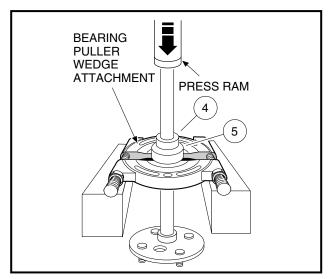


Figure 16-6 Bearing and Collar

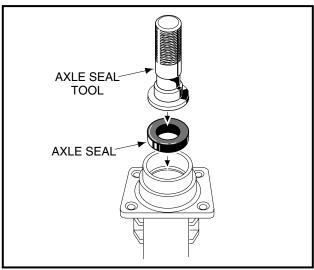


Figure 16-7 Axle Seal Tool

TRANSAXLE Axle Bearing and Shaft

A CAUTION

• DO NOT TIGHTEN THE BEARING PULLER WEDGE ATTACHMENT AGAINST THE AXLE SHAFT. THIS COULD DAMAGE THE AXLE SHAFT WHEN PRESSING OFF THE BEARING AND COLLAR.

NOTE

IT MAY BE NECESSARY TO HEAT THE COLLAR BEFORE THE COLLAR CAN BE REMOVED.

Axle Bearing Installation (Type K Transaxles Only)

- 1. If removed, place retaining ring (6) on axle shaft (1 or 2) (Figure 16-3, Page 16-3). The retaining ring will be loose on the axle shaft until it is installed into the axle tube.
- 2. Apply two drops of Loctite® 271 to the inside of the collar.

A CAUTION

- APPLY LOCTITE[®] 271 TO INSIDE OF COLLAR ONLY, NOT TO THE SHAFT, SO THE LOCTITE WILL BE PUSHED AWAY FROM THE BEARING AS THE COLLAR AND BEARING ARE PRESSED ON. IF LOCTITE GETS ON OR IN THE BEARING, THE BEARING MUST BE REPLACED.
- THE COLLAR SHOULD BE REMOVED NO MORE THAN TWO TIMES. IF A BEARING IS REMOVED A THIRD TIME, THE SHAFT AND COLLAR WILL NOT GIVE A PROPER FIT.
- 3. Place the bearing and the collar on the shaft (note, this is a sealed bearing). See following CAUTION.

A CAUTION

- IF THE BEARING WAS REMOVED FROM THE SHAFT, REPLACE BEARING WITH A NEW ONE.
- 4. Place the bearing puller wedge attachment against the collar and press on both the bearing and collar. **See CAUTION on page 16-6.**
- Install retaining ring (7) into the groove on the axle shaft (Figure 16-3, Page 16-3).

Axle Shaft and Oil Seal Installation

- 1. Clean bearing and seal seats in the axle tube (16 or 40) (Figure 16-3, Page 16-3) or (14 or 35) (Figure 16-4, Page 16-4).
- 2. Place a new seal (17) (Figure 16-3) or (15) (Figure 16-4) in the axle tube with the seal lip facing away from the bearing. Use an axle seal tool (Club Car Part No. 1014162) and mallet to tap it in until it seats firmly in position (Figure 16-7, Page 16-5). A hydraulic press may also be used with the axle seal tool.
- 3. Clean the shaft splines and then insert the shaft, splined end first, through the seal and into the axle tube. Be careful not to damage the seal. Then advance the shaft through the inner bearing and rotate it to align the shaft splines with the splined bore of the differential side gear. Continue advancing the shaft until the bearing seats against the axle tube shoulder.
- Using snap ring pliers, install retaining ring (6) inside axle tube (Figure 16-3 or 16-4, Pages 16-3 or 16-4).
 See following NOTE.

NOTE

• TYPE G TRANSAXLES: IF RETAINING RING (6) MUST BE REPLACED, THE ENTIRE AXLE SHAFT ASSEMBLY (1 OR 2) MUST BE REPLACED (FIGURE 16-4, PAGE 16-4).

5. Place a 1/4 inch to 3/8 inch (6 to 10 mm) diameter rod against the retaining ring and tap lightly at four to five locations around the retaining ring to ensure it is properly seated. **See following WARNING.**

WARNING

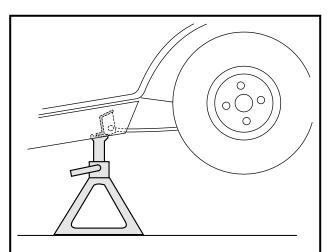
• BE SURE THE RETAINING RING IS PROPERLY SEATED IN ITS GROOVE. IF THE RING IS NOT PROPERLY INSTALLED, THE AXLE ASSEMBLY WILL SEPARATE FROM THE TRANSAXLE AND DAMAGE THE AXLE ASSEMBLY AND OTHER COMPONENTS. LOSS OF VEHICLE CONTROL COULD RESULT, CAUSING SEVERE PERSONAL INJURY.

TRANSAXLE

Read DANGER and WARNING on page 16-1.

TRANSAXLE REMOVAL

- 1. Place chocks at the front wheels and slightly loosen the lug nuts on both rear wheels.
- 2. Place floor jack under transaxle and raise rear of vehicle (Figure 16-8, Page 16-7) then place jackstands under frame cross-member between the spring mount and the side stringer, just forward of each rear wheel. Lower the vehicle to let the jackstands support the vehicle.
- 3. Remove the rear wheels, then thread one lug nut onto a stud on each rear hub. This will keep the brake drums on the hubs.
- 4. Remove the cotter pins (1), brake cable clevis pins (2), and cable retaining E-clips (3). Disconnect the brake cables (4) (Figure 16-9, Page 16-7).
- 5. Disconnect the shock absorbers from their lower mounts (Figure 16-13, Page 16-9).



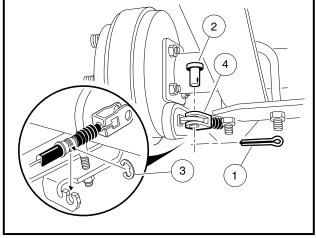


Figure 16-8 Support Vehicle on Jackstands

Figure 16-9 Disconnect Brakes

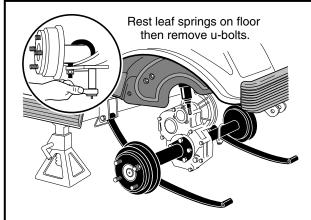
- 6. Disconnect the four motor wires. Use two wrenches to prevent the post from turning.
- 7. With a floor jack supporting the transaxle, remove lower spring shackle nuts and bolts. Position shackles so they are clear of springs (Figure 16-14, Page 16-9).
- 8. If a chain hoist was used to raise the vehicle, lift the vehicle high enough to permit easy access and clearance for removal of the motor. If a floor jack was used to raise the vehicle, lower the transaxle enough to permit easy access and clearance for removal of the motor.
- 9. Remove the three motor mounting bolts (Figure 16-11, Page 16-8), and the motor positioning bolt (Figure 16-12, Page 16-8) mounting the motor to the transaxle. See following WARNING.

TRANSAXLE

Tranaxle Removal, Continued:

WARNING

• DO NOT POSITION FINGERS UNDER MOTOR WHEN SLIDING OFF INPUT SHAFT IN STEP 9. FINGERS MAY GET PINCHED WHEN MOTOR DISENGAGES.



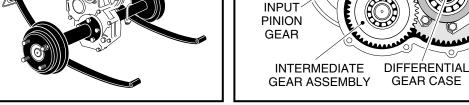


Figure 16-10 Leaf Springs

Figure 16-11 Motor Mounting Bolts

MOTOR MOUNTING

BOLTS

- 10. Carefully remove the motor from the transaxle. Slide the motor away from the transaxle until the motor spline becomes disengaged from the input shaft, then lift motor out. **See preceding WARNING.**
- 11. If a floorjack was used, pull floorjack from beneath the transaxle and allow the springs to rest on the floor.
- 12. Remove the U-bolts attaching the transaxle to the leaf springs (Figure 16-10, Page 16-8).
- 13. Carefully lift each end of the transaxle off its positioning pin (on the leaf spring) and slide the transaxle to the rear and out of the vehicle.
- 14. Drain the lubricant from the transaxle and remove the axle shafts as instructed on page 16-2. **See also NOTE on page 16-2.**
- 15. If removal of the brake assemblies is required, see Section 6–Wheel Brake Assemblies in the Maintenance and Service Manual.

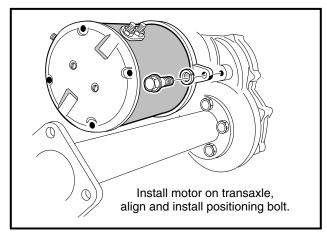
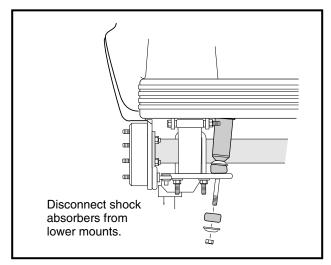


Figure 16-12 Motor Positioning Bolt



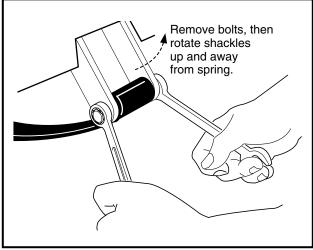


Figure 16-13 Disconnect Shocks

Figure 16-14 Shackles

TRANSAXLE DISASSEMBLY, INSPECTION AND ASSEMBLY

Read DANGER and WARNING on page 16-1.

TRANSAXLE DISASSEMBLY AND INSPECTION

1. To detach axle tubes (16 and 40) (Figure 16-3, Page 16-3) or (14 and 35) (Figure 16-4, Page 16-4) from the transaxle housing, remove the bolts and lock washers (8 and 9) (Figure 16-3 or 16-4).

NOTE

- TYPE K TRANSAXLES ONLY: SHIMS ARE LOCATED BETWEEN AXLE TUBE AND DIFFERENTIAL CASE BEARING. DO NOT DAMAGE SHIMS. IF SHIMS ARE REMOVED, SET THEM ASIDE FOR REINSTALLATION.
- 2. Remove 10 bolts (26) (Figure 16-3, Page 16-3) or 11 bolts, (24) (Figure 16-4, Page 16-4) that hold housing together.
- 3. Pull the halves of the housing apart. If necessary, tap lightly on the spline of the input pinion.

A CAUTION

- TO PREVENT DAMAGE TO THE HOUSING MATING SEAL SURFACES, USE CAUTION WHEN SEPARATING HALVES.
- 4. Remove input pinion gear by pulling gear (19) (Figure 16-3, Page 16-3) or (17) (Figure 16-4, Page 16-4) out while rocking intermediate gear assembly. Lift intermediate gear assembly and differential gear case unit out simultaneously.

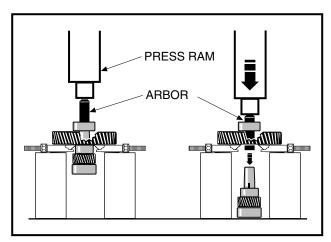
A CAUTION

- DO NOT DAMAGE GEARS. USE EXTREME CARE WHEN HANDLING THEM.
- 5. Use a bearing puller or arbor press to remove bearings (18) (Figure 16-3, Page 16-3) or (16) (Figure 16-4, Page 16-4) from the input pinion gear. If the oil seal (10) is damaged, replace it (Figures 16-3 or 16-4, Pages 16-3 or 16-4). See also Figure 16-15, Page 16-10. See following CAUTION.

Transaxle Disassembly and Inspection, Continued:

CAUTION

DO NOT REUSE BEARINGS AFTER REMOVING THEM. REPLACE BEARINGS WITH NEW ONES.



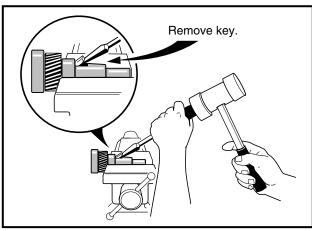
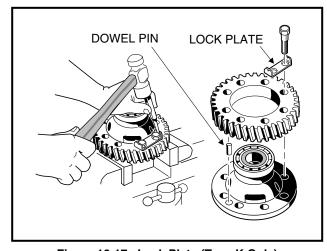


Figure 16-15 Intermediate Gear Assembly

Figure 16-16 Remove Key

- 6. To disassemble the intermediate gear assembly, press off together the bearing (18) (Figure 16-3, Page 16-3) or (16) (Figure 16-4, Page 16-4) and the gear (23) (Figure 16-3, Page 16-3) or (19) (Figure 16-4, Page 16-4). See also Figure 16-15, Page 16-10.
- 7. Type K transaxles: Remove key (22) (Figure 16-3, Page 16-3). See also Figure 16-16, Page 16-10.
- 8. Press the bearing (20) (Figure 16-3, Page 16-3) or (18) (Figure 16-4, Page 16-4) off the intermediate gear assembly.





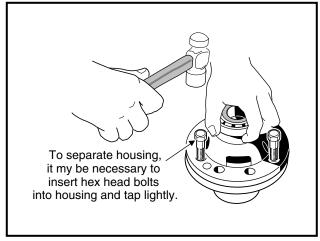
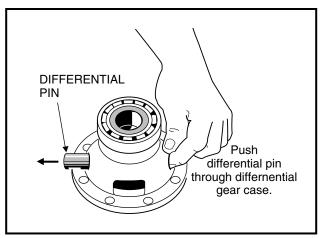


Figure 16-18 Separate Housing

- 9. Disassemble the differential gear case:
 - 9.1. Type K transaxles: Bend the bolt lock plates (29) down onto the ring gear (30) (Figure 16-3, Page 16-3). See also Figure 16-17, Page 16-10.
 - 9.2. Remove eight hex bolts (28) (Figure 16-3, Page 16-3) or four hex bolts, (33) (Figure 16-4, Page 16-4), that secure the ring gear to the differential case.
 - 9.3. Remove the ring gear. Retain dowel pin from between ring gear and differential case for reassembly.

- 9.4. Separate the differential gear case housing. If necessary, reinstall two of the hex bolts (removed previously in step 9.2.) into the differential gear unit and, while holding the unit slightly above the work area, lightly tap the bolt heads (**Figure 16-18**, **Page 16-10**). Remove the two bolts.
- 9.5. Remove the differential pin (31) by pushing pin through differential gear case from one side (Figures 16-3 or 16-4, Pages 16-3 or 16-4). See also Figure 16-19, Page 16-11.



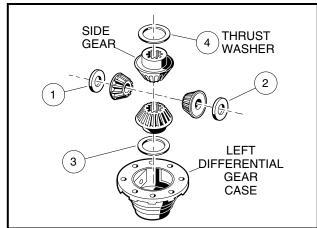


Figure 16-19 Differential Pin

Figure 16-20 Left Differential

- 9.6. Remove the idler gears and thrust plates (38 and 35), **(Figure 16-3, Page 16-3)** or (29 and 28) **Figure 16-4, Page 16-4)**.
- 9.7. Remove the differential gears and thrust plates (34 and 37) (Figure 16-3, Page 16-3) or (30 and 27) (Figure 16-4, Page 16-4). See also Figure 16-20, Page 16-11.
- 9.8. Inspect the bearings (14) (Figure 16-3, Page 16-3) or (13) (Figure 16-4, Page 16-4) of the differential case and replace them if they are damaged. To remove them, press them off. See CAUTION at bottom of page 16-10.
- 10. Inspect parts for wear or damage. Any worn or damaged parts should be replaced. See following NOTE.

NOTE

DAMAGED OR WORN GEARS SHOULD BE REPLACED AS SETS.

TRANSAXLE ASSEMBLY

A CAUTION

- DO NOT PRESS AGAINST THE BEARING OUTER RACE.
- TYPE K TRANSAXLES: GASKET (13) FACES OF THE HOUSING MUST BE CLEAN AND SMOOTH. USE ONLY A NEW GASKET THAT IS NOT TORN OR DAMAGED. THE GASKET MUST LIE FLAT AGAINST THE HOUSING FACES (FIGURE 16-3, PAGE 16-3).
- THE HOUSING AND ALL PARTS MUST BE WIPED CLEAN AND DRY BEFORE REASSEMBLY.
- 1. If bearings (14) (Figure 16-3, Page 16-3) or (13) (Figure 16-4, Page 16-4) were removed during disassembly, install new bearings using an arbor press.
- 2. Assemble the differential gear case.
 - 2.1. Install the pin (31) (Figures 16-3 or 16-4, Pages 16-3 or 16-4). Apply a small amount of oil to all thrust plates and to both ends of the pin.

Type K transaxles:

- 2.2. While aligning the dowel pin, assemble the two halves of the differential gear case (33 and 36) and reinstall the output gear (30) (Figure 16-3, Page 16-3).
- 2.3. Install eight hex bolts (28) and the bolt lock plates (29) (Figure 16-3, Page 16-3). Tighten the bolts to 18 ft-lb (24 N-m).
- 2.4. Bend the edges of the bolt locking tabs securely against the flats of the bolt heads to prevent the bolts from loosening and possibly causing damage (Figure 16-17, Page 16-10).
- 2.5. If the large gear (23) was removed from the intermediate gear, insert key (22) into keyway in the shaft and then press the large gear and the bearing (18) onto the shaft. Be sure the key is properly positioned in the keyway before attempting to press on the large gear and bearing (Figure 16-3, Page 16-3).

Type G transaxles:

2.6. Install four hex bolts (33) and output gear (32). Tighten bolts to 51 ft-lb (69 N-m) (Figure 16-4, Page 16-4).

· All transaxles:

- 3. Press a new bearing (20) (Figure 16-3, Page 16-3) or (18) (Figure 16-4, Page 16-4) onto the intermediate gear assembly.
- 4. Press new bearing (18) (Figure 16-3, Page 16-3) or (16) (Figure 16-4, Page 16-4) onto input pinion gear.
- 5. Apply grease to the lip of the new oil seal (10) (Figures 16-3 or 16-4, Pages 16-3 or 16-4) and install the seal using a transaxle pinion seal tool (Club Car Part No. 1014161). The lip of the oil seal should face the inside of the transaxle housing. Make sure the seal is firmly seated.
- 6. Install the differential assembly, the intermediate gear assembly, and the input pinion gear simultaneously. Be sure all bearings are seated properly in the housing. Rotate the input shaft to check for smooth gear operation (Figure 16-11, Page 16-8).
- 7. Install both dowel pins (27) (Figure 16-3, Page 16-3) or (25) (Figure 16-4, Page 16-4) in the transaxle housing (24 or 20).
- 8. Install left half of transaxle housing:

For Type K transaxles:

- 8.1. Place a new gasket (13) (Figure 16-3, Page 16-3) in position on the mating face of the housing. Use the dowel pins to position the gasket. Make sure all holes are aligned.
- 8.2. Install left half of transaxle housing (24) (Figure 16-3, Page 16-3).
- 8.3. Install the ten bolts (26) and tighten to 69 in-lb (7.8 N-m) (Figure 16-3, Page 16-3).
- 8.4. If the axle tube (16 and 40) was removed, install the shims (39), (if the shims were removed) and a new gasket. Install the axle tube with five lock washers and bolts (9 and 8) (Figure 16-3, Page **16-3).** Tighten the bolts to 36 ft-lb (49 N-m).

NOTE

• TYPE K TRANSAXLES: IF THE DIFFERENTIAL CASE (33 AND 36), THE TRANSAXLE HOUSING (11 AND 24) OR AXLE TUBE (16 AND 40) (FIGURE 16-3, PAGE 16-3) WAS REPLACED, SEE SHIMMING THE TRANSAXLE ON PAGE 16-13.

• For Type G transaxles:

- 8.1. Place 1/8 inch bead of three bond liquid gasket on mating face of housing. See following NOTE.
- 8.2. Install left half of transaxle housing (20) (Figure 16-4, Page 16-4).
- 8.3. Install eleven bolts in the case housing and tighten to 19 ft-lb (25.7 N-m). Type G transaxles have no shims or gasket.

NOTE

- TYPE G TRANSAXLES DO NOT USE A GASKET ON THE MATING FACE OF THE HOUSING. USE AN 1/8 INCH BEAD OF THREE BOND LIQUID GASKET INSTEAD.
 - 8.4. Install axle tube with lock washers and bolts (9 and 8) (Figure 16-4, Page 16-4). Tighten the bolts to 36 ft-lb (49 N-m).

• For all transaxles:

- 9. Install the brake assemblies as instructed in Section 6-Wheel Brake Assemblies.
- 10. Apply a small amount of grease to the lip of the oil seal (17) (Figure 16-3, Page 16-3) or (15) (Figure 16-4, Page 16-4).
- 11. Clean the splines on the axle shaft (1 and 2). Rotate the axle to align the shaft splines with the splined bore of the differential side gear. Push the shaft in until the bearing seats against the shoulder in the axle tube (Figures 16-3 and 16-4, Pages 16-3 and 16-4).
- 12. Install the retaining ring (6) (Figures 16-3 and 16-4, Pages 16-3 and 16-4) in the axle tube. See WARNING on page 16-7.
- 13. Make sure the drain plug is installed in the transaxle and tightened to 23 ft-lb (31 N-m). Fill the transaxle, through the level indicator hole, with 22 ounces of SAE 30 API Class SE, SF, or SG oil (a higher grade may also be used). Install and tighten the level indicator plug to 23 ft-lb (31 N-m).

SHIMMING THE TRANSAXLE

Type K Transaxles Only

If the differential case (36 and 33), transaxle housing (11 and 24), or axle tube (16 and 40) has been replaced, the transaxle may need new shims. To determine whether new shims are necessary, the transaxle must be completely assembled except for the short axle tube (16) and both axle shafts (1 and 2) (Figure 16-3, Page 16-3).

- 1. Stand the transaxle on end, on the axle tube.
- 2. Using a depth gauge, measure the distance from the gasket seal surface of the axle tube (gasket must be removed) to the outer race of the bearing (14) on the differential case assembly (32) (Figure 16-3, Page 16-3) See also Figure 16-21, Page 16-13.

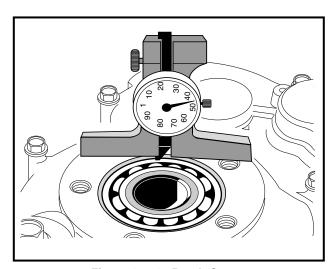


Figure 16-21 Depth Gauge

TRANSAXLE Transaxle Installation

Shimming the Transaxle, Continued:

3. Use the following charts to determine whether shimming is required and, if so, how many shims (Club Car Part No. 1013781) should be used.

Distance from gasket seal surface to outer race or bearing - INCHES (MM)	SHIMS REQUIRED
Up to .134 inches (3.4 mm)	0
.134142 inches (3.4 - 3.6 mm)	1
.142150 inches (3.6 - 3.8 mm)	2
.150155 inches (3.8 - 3.9 mm)	3

TRANSAXLE INSTALLATION

See DANGER and WARNING on page 16-1.

- 1. If using a chain hoist, raise the vehicle and place transaxle in position on the jackstands. If using a floor jack, lower the jackstands to their lowest settings and place the transaxle in position on the jackstands.
- 2. Align the center hole in the saddle of the transaxle with the pilot bolt in the leaf spring assembly.
- 3. Install the two U-bolts, jounce bumper mount and spacers, lockwashers, and nuts. Tighten the nuts to 25 ft-lb (34 N-m). Tighten the U-bolt nuts so an equal amount of thread is visible on each leg of the bolt.
- Install the motor. See Section 15-Motor.
- 5. If using a chain hoist, lower the vehicle while guiding the leaf springs into the rear spring shackles. If using a floor jack, raise the differential while guiding the leaf springs into the rear spring shackles. Then raise the jackstands to support the transaxle.
- 6. Reconnect the four motor wires. Tighten the retaining nuts to 65 in-lb (7.3 N-m). Use two wrenches to prevent the motor posts from turning. **See following NOTE.**

NOTE

- IF THE MOTOR WIRES WERE NOT TAGGED WHEN DISCONNECTED, SEE SECTION 11, FIGURES 11-2 THROUGH 11-6, PAGES 11-3 THROUGH 11-7, WIRING DIAGRAMS FOR PROPER CONNECTION.
- 7. Insert bolts through the spring shackles and bushings in the leaf spring eyes. Secure bolts with lock nuts. Tighten to 15 ft-lb (20.3 N-m).
- 8. Connect the brake cables.
- 9. Install the shock absorbers. Tighten shock absorber retaining nuts until the rubber bushings expand to the same size as the cup washers.
- 10. Install the rear wheels and finger tighten lug nuts.
- 11. Lift the vehicle and remove the jackstands. Lower vehicle and tighten lug nuts (using a crisscross pattern) to 55 ft-lb (74.6 N-m).
- 12. Test drive the vehicle to check for proper operation.

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Club Car Inc. P.O. Box 204658 Augusta, GA 30917-4658